American Journal of Diseases of Children

VOLUME 31 FEBRUARY, 1926 NUMBER 2

HOOKWORM INFESTATION

THE EFFECT OF VARYING INTENSITIES ON THE PHYSICAL CONDITION OF SCHOOL CHILDREN *

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The organization of the extensive hookworm campaigns carried out in many parts of the world has been based on certain general principles. One of the most widely adopted of these is the assumption that every person whose feces contain ova should be considered a case of hookworm disease. It is now clear, however, that this assumption is untenable. In the economic control of hookworm disease, the essential factor is not the presence of hookworm infestation in an individual or in a community, but its existence in sufficiently severe form to be of economic importance.

From studies made in North, South, and Central America, various workers have drawn a distinction between light infestation with hookworms, or a carrier state, and heavy infestation, or hookworm disease. This view has been vigorously challenged by Dr. Clayton Lane [1] (Lane, 1922) and others, who hold that any case of infestation must be considered disease. This difference of opinion is fundamental. If the latter view is correct, no studies of intensity need be considered; the chief duty of the scientific administrator would be to develop a better diagnostic method for the determination of infestation, and to treat every positive case until cured. If the former view is correct, it is necessary to develop some method of measuring the intensity of infestation, and yet more important to determine the degrees of infestation which should properly be regarded as (1) a carrier state, and (2) disease.

The issue has not been clearly drawn in this discussion, for the term "hookworm infestation" has included infestation both with *Necator americanus* and *Ancylostoma duodenale*. Infestation with *Ancylostoma duodenale* is a much more serious condition than infestation with *Necator*

* Received for publication, Nov. 6, 1925.

1. Lane, Clayton: The Mass Diagnosis of Ancylostome Infestation, Part 1, Tr. Roy. Soc. Trop. Med. & Hyg. **16**:274, 1922; On Ancylostome Infestation. The Enlarging Problem, Brit. M. J. **1**:551-553 (March 31) 1923.

americanus, and the general plan of control applied to the one cannot be applied to the other. Fortunately, the infestation in the southern United States is due solely to *Necator americanus,* and the studies herewith presented, together with conclusions derived from them, apply only to areas in which *Necator americanus* is the important infective agent. It is also most fortunate that in the area studied, no intestinal parasites other than *Necator americanus* were found, with the unimportant exception of *Hymenolepis nana,* which occurred in about 3 per cent. of the children examined.

Theoretically, every hookworm in the intestine is producing a pathologic process. It is conceivable that infestation with a single hookworm or a few hookworms may cause injury not at present measurable, but which at some remote time may produce definite harm to the infested individual. Though this may be conceivable, every one who is at all familiar with hookworm disease in the field and who has given the matter serious attention, has noted that a large number of persons whose feces contain hookworm ova are apparently perfectly well and strong. If the few hookworms harbored are causing harm, it is not apparent. If the injury produced is sufficient to affect the person's life to any degree, there should be some signs of physical retardation or lowered physical fitness, and consequently we should be able to devise some means of measuring the damage.

Children are probably more susceptible to the effects of hookworm infestation than adults. Standard measurements of southern white children of American parentage have been established, so that we have a basis of comparison for subnormal children. If any measurable injury is caused by hookworm infestation, it should definitely affect the physical development of the growing child. If light infestations are found to have little or no effect on the normal growth and development of a child, then it seems fair to assume that they would have no greater deleterious effect on adults.

It is futile to proceed along the old lines of hookworm control if one of the basic principles is untenable. It is also unwise to assume that light infestations cause no serious harm to the person, until some measure has been made of the injury caused by varying intensities of hookworm infestation. Until such a study has been made, we have no basis for deciding within what limits of intensity the infestation may be considered a carrier state, or an actual case of hookworm disease. In the studies here presented, an attempt was made to determine the effect of varying degrees of intensity of hookworm infestation on the development and growth of school children.

It is difficult to obtain a large group of children in which variation in the intensity of hookworm infestation is the only variable factor. Our Brazilian studies (Smillie,[7] 1922) showed that good nutrition plays

a great part in the bodily resistance to the effect of hookworms. Infested adult dairy workers who drank several liters of milk a day had normal hemoglobins, despite an average infestation of 400 hookworms each. Their companions who had a similar intensity of infestation but drank no milk showed a definite lowering of the hemoglobin. Age also plays a part. In Brazil, very young children (from 5 to 7 years of age) seemed to be more affected by infestation than older children harboring the same number of worms. Darling, Barber, and Hacker [2] (1920) showed that persons infested with both hookworms and malaria had a much lower hemoglobin than their fellows harboring the same number of worms but free from malaria.

In the present studies, we rejected all patients having outstanding physical defects, and included no children from malarial areas. Negroes and whites were considered separately. The economic status of the groups studied may be considered a constant, and all the white children belong to the same racial stock. The variation in hookworm intensity in the groups studied was due in great part to a variation in type of soil on which the people live. This gave us an opportunity for field studies practically under laboratory conditions, in that we were able to observe and to compare children in whom the principal variable factor was the intensity of the hookworm infestation.

METHODS OF PROCEDURE

Groups of children from villages and rural districts were measured by the methods adopted by the U. S. P. H. Service and used by Clark, Sydenstricker, and Collins [3] (1923) in their studies of school children in the United States. The measurements employed were standing height, weight, stem length, hemoglobin and vital capacity. Certain other measurements were also made, but are not included in this analysis. Ova counts by the Stoll method were made on each child to determine the intensity of the hookworm infestation. In analyzing the results, the children were divided into six groups according to the estimated intensity of their infestation:

Group 1, negative.

Group 2, very light infestation, from 1 to 25 worms.

Group 3, light infestation, from 26 to 100 worms.

Group 4, moderate infestation, from 101 to 500 worms.

Group 5, heavy infestation, from 501 to 1,000 worms.

Group 6, very heavy infestation, from 1,001 to 3,000 worms.

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2. Darling, S. T.; Barber, M. A., and Hacker, H. P.: Report of Uncinariasis Commission to the Orient, 1915-1917, Rockefeller Foundation, Pub. No. 9, 1920.

3. Clark, T.; Sydenstricker, E., and Collins, S. D.: Heights and Weights of School Children, U. S. P. H. Report, Reprint No. 750, pp. 1185-1207, 1922; Weight and Height as an Index of Nutrition, U. S. P. H. Report, Reprint No. 809, pp. 39-58, 1923.

This is a very arbitrary grouping, but useful for purposes of comparison. In many instances, Groups 2 and 3 have been combined, as well as Groups 5 and 6, giving us four groups, namely, negative cases, and light, moderate and heavy infestations.

We have found the Stoll method of ova counting to be a very satisfactory measure of the intensity of the hookworm infestation of a community. Unless a series of samples are taken on a single person, the method is not a satisfactory index of the exact number of worms harbored by an individual, but it is of no great importance whether or not we know the exact number of worms harbored by an individual. We desire to know whether a subject has a light, a moderate or a heavy infestation, and this information is given us by the Stoll method.

As a standard of comparison of the measurements of weight and standing height of the various groups, we have used Dr. Clark's [3] tables of normal white children of the southern states, of American parentage (Clark and his co-workers, 1922). The stem length was not measured by Clark in this series. We have, therefore, compared stem length with that of the group of normal children having good nutrition in another study of American school children (Clark and his co-workers, 1923). For the standard of comparison of vital capacity, Stewart's [4] tables for white American school children were used (Stewart, 1922). The hemoglobin rates were ascertained by the Dare apparatus, checked constantly by the Newcomber apparatus. Practically all hemoglobin determinations were done by the same observer with the same instrument.

Weight.—Record was taken of the weight and the intensity of the hookworm infestation of 1,821 children, of whom 1,280 were white and 541 negro. At the weighing, the children were barefooted and wore little clothing—shirt and overalls in the case of the boys, and correspondingly light garments in the case of the girls.

The effect of varying degrees of hookworm intensity on the normal increase in weight of growing children is shown in Tables 1 and 2. The children were grouped in two-year age periods. The age recorded is the age on the nearest birthday. We have calculated for each age group (1) the mean weight and its probable error; (2) the standard deviation and its probable error, and (3) the coefficient of variation.[5] The children have been grouped according to the intensity of their infestation in four groups: negative cases, light infestations (from 1 to 100 hookworms), moderate infestations (from 101 to 500 hookworms), and heavy infestations (from 501 to 3,000 hookworms). Boys and girls are

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4. Stewart, Chester, A.: The Vital Capacity of the Lungs of Children in Health and Disease, Am. J. Dis. Child. **24**:451-496 (Dec.) 1922.

5. For the sake of brevity, only the mean weights with probable error have been given in the printed tables. The other data may be obtained from the authors on application.

considered separately, as are negro and white children. There were so few cases of moderate or heavy infestation among the negro children that only two groups of intensity could be calculated, namely, negatives and light infestations. We found a fairly high hookworm incidence in

TABLE 1.—*Mean Weight in Pounds in Relation to Hookworm Intensity in White Children*

Age, Years	No Hookworms		Light Infestation, 1 to 100 Worms		Moderate Infestation, 101 to 500 Worms		Heavy Infestation, 501 to 3,000 Worms	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
6-7	46.75 ±0.56 40 cases	47.41 ±0.59 61 cases	48.11 ±0.99 19 cases	49.78 ±1.18 18 cases	47.0 ±0.92 12 cases	50.33 ±1.2 15 cases	51.0 ±1.04 5 cases	53.66 ±1.74 3 cases
8-9	60.39 ±0.89 65 cases	57.80 ±0.66 82 cases	62.32 ±0.88 46 cases	59.02 ±0.88 42 cases	58.67 ±1.41 21 cases	56.09 ±0.93 22 cases	53.66 ±0.78 3 cases	57.0 ±1.18 4 cases
10-11	68.08 ±1.01 51 cases	68.99 ±0.94 73 cases	71.63 ±0.94 53 cases	66.64 ±1.0 56 cases	71.17 ±1.32 30 cases	66.62 ±1.04 26 cases	70.34 ±1.8 9 cases	67.50 ±3.08 9 cases
12-13	81.49 ±1.25 39 cases	87.98 ±1.44 51 cases	84.11 ±1.45 38 cases	83.84 ±1.33 46 cases	82.83 ±1.66 30 cases	87.51 ±2.26 19 cases	78.03 ±3.7 7 cases	79.14 ±3.0 7 cases
14-15	101.6 ±1.9 28 cases	99.03 ±2.1 27 cases	105.2 ±2.77 28 cases	101.16 ±2.04 30 cases	97.70 ±2.85 21 cases	97.7 ±2.0 10 cases	92.0 ±2.7 7 cases	86.17 ±4.04 7 cases
16-17	121.57 ±2.4 23 cases	112.41 ±2.89 12 cases	127.35 ±2.62 28 cases	114.8 ±2.34 16 cases	119.5 ±4.91 12 cases	100.75 ±3.8 4 cases	107.0 ±3.12 3 cases	

TABLE 2.—*Mean Weight in Pounds in Relation to Hookworm Intensity in Negro Boys and Girls*

Age, Years	Group 1, No Hookworms		Groups 2 and 3, 1 to 100 Hookworms	
	Boys	Girls	Boys	Girls
6 to 7	48.57 ±0.91 26 cases	48.83 ±1.1 30 cases	52.0 ±2.11 7 cases	50.58 ±0.25 7 cases
8 to 9	57.80 ±1.15 30 cases	57.05 ±0.77 51 cases	58.66 ±2.46 9 cases	61.0 ±1.33 10 cases
10 to 11	68.41 ±1.05 39 cases	72.62 ±1.30 56 cases	70.34 ±1.27 18 cases	74.70 ±2.57 13 cases
12 to 13	84.14 ±1.40 42 cases	89.85 ±1.48 46 cases	85.62 ±2.05 18 cases	90.19 ±2.64 11 cases
14 to 15	101.44 ±2.37 27 cases	107.78 ±2.01 32 cases	99.27 ±4.63 11 cases	112.77 ±3.43 13 cases
16 to 17	125.17 ±2.95 8 cases	117.0 ±1.86 19 cases	139.0 ±4.32 5 cases	119.15 ±7.48 7 cases

negroes, but a low intensity. This question of racial immunity will be discussed in a subsequent paper.

Chart 1 is a graphic representation of Tables 1 and 2. The curves for the girls only are given. The boys' curves show the same tendencies as those of the girls. In Graph A, we have compared the

growth curve of white girls negative on stool examination with Clark's tables of normal white children. The two curves correspond very closely. Graph B gives the weight curve of lightly infested girls (Groups 2 and 3), plotted against the standard. The two curves are almost identical, indicating that light hookworm infestation has no effect on normal increase in weight. Graph C compares Group 4, or the

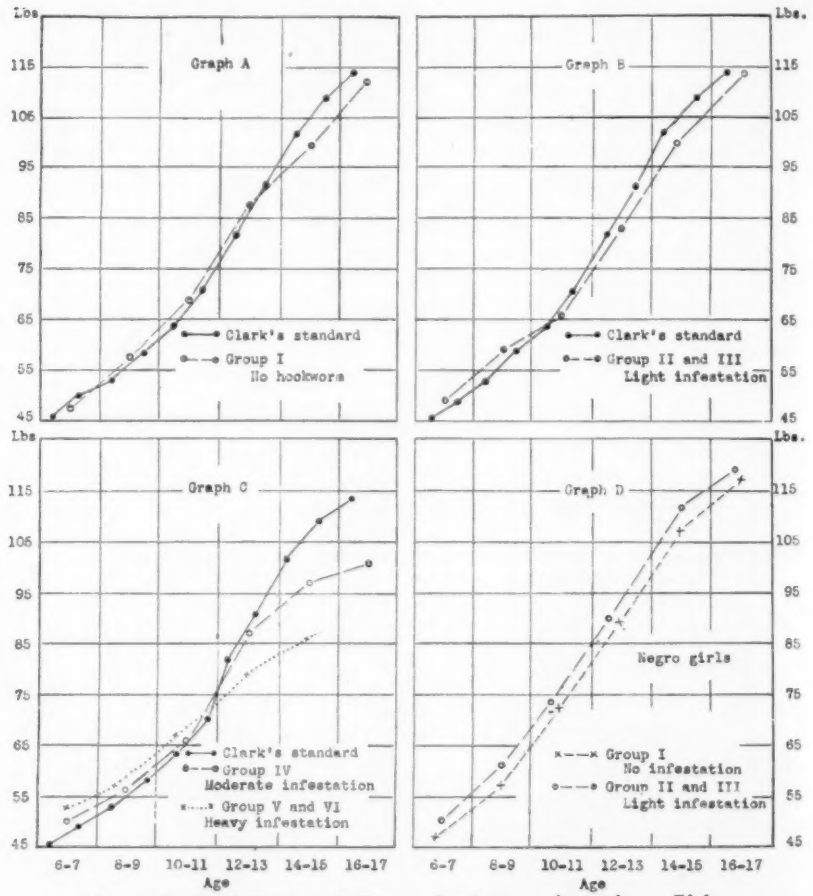

Chart 1.—Weight in relation to hookworm intensity. Girls.

moderate infestations, and Groups 5 and 6, or the heavy infestations, with the standard. Both the moderate and heavy infestation groups are slightly above the normal weight in the first age period. This may be due to edema, which is more prevalent in the heavily infested younger age groups. It is more probably due to the fact that there were more 7 year old than 6 year old children in the 6 to 7 age groups. The three curves run more or less parallel until the 12 to 13 age period, when there begins a divergence in the groups with hookworm infestation. In

the older age periods, Group 4 children weigh 10 pounds (4.5 kg.) less than normal children. The heavily infested groups average 15 pounds (6.8 kg.) underweight, showing a definite retardation in growth due to the severe hookworm infestation.

TABLE 3.—*Mean Standing Height in Inches in Relation to Hookworm Intensity in White Children*

Age, Years	No Hookworms		Light Infestation, 1 to 100 Worms		Moderate Infestation, 101 to 500 Worms		Heavy Infestation, 501 to 3,000 Worms	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
6-7	45.89 ±0.26 43 cases	45.96 ±0.19 59 cases	45.94 ±0.42 18 cases	46.85 ±0.41 17 cases	45.33 ±0.22 12 cases	47.11 ±0.63 15 cases	46.1 ±0.36 5 cases	47.8 ±0.14 3 cases
8-9	50.25 ±0.25 65 cases	50.8 ±0.27 80 cases	51.06 ±0.28 46 cases	50.11 ±0.22 41 cases	49.88 ±0.49 26 cases	50.18 ±0.42 23 cases	48.5 ±0.49 3 cases	49.83 ±0.3 3 cases
10-11	53.31 ±0.22 52 cases	54.06 ±0.23 69 cases	54.17 ±0.17 49 cases	53.3 ±0.20 63 cases	53.40 ±0.4 29 cases	53.46 ±0.27 27 cases	52.5 ±0.4 9 cases	52.5 ±0.78 9 cases
12-13	58.64 ±0.41 43 cases	58.5 ±0.28 50 cases	57.32 ±0.33 39 cases	58.23 ±0.26 45 cases	57.05 ±0.34 29 cases	57.97 ±0.34 19 cases	56.04 ±0.42 13 cases	56.3 ±0.84 11 cases
14-15	61.77 ±0.38 41 cases	58.8 ±0.43 27 cases	62.28 ±0.39 27 cases	61.03 ±0.33 30 cases	60.58 ±0.60 23 cases	60.9 ±0.36 10 cases	59.33 ±0.70 11 cases	58.5 ±0.76 6 cases
16-17	65.66 ±0.49 22 cases	62.0 ±0.41 12 cases	65.26 ±0.32 29 cases	62.12 ±1.26 16 cases	63.66 ±0.76 12 cases	61.0 ±0.186 4 cases	63.83 ±0.13 3 cases	

TABLE 4.—*Mean Standing Height in Inches in Relation to Hookworm Intensity in Negro Boys and Girls*

Age, Years	Group 1, No Hookworms		Groups 2 and 3, 1 to 100 Hookworms	
	Boys	Girls	Boys	Girls
6 to 7	46.41 ±0.54 22 cases	46.97 ±0.43 30 cases	46.84 ±0.72 7 cases	48.7 ±0.24 7 cases
8 to 9	49.71 ±0.36 33 cases	50.9 ±0.27 50 cases	49.39 ±0.41 9 cases	52.68 ±0.76 11 cases
10 to 11	53.17 ±0.25 39 cases	54.69 ±0.29 54 cases	54.17 ±0.37 18 cases	54.81 ±0.59 13 cases
12 to 13	57.79 ±0.34 45 cases	58.68 ±0.40 46 cases	56.03 ±0.43 17 cases	57.95 ±0.56 11 cases
14 to 15	60.91 ±0.66 29 cases	60.32 ±0.48 33 cases	60.5 ±0.99 11 cases	60.78 ±0.43 14 cases
16 to 17	64.50 ±0.09 8 cases	62.60 ±0.35 20 cases	67.70 ±0.79 5 cases	60.78 ±0.86 7 cases

The last graph of Chart 1 gives the curves of weight increase in negroes. We have included only normal cases (Group 1) and light infestations (Groups 2 and 3). The weight curves of the lightly infested negroes show no marked variation from the curves of the Group 1, or normal children. These tables and charts indicate that a

hookworm infestation of an intensity of from 1 to 100 worms in either whites or negroes has no measurable effect on the normal rate of growth in children.

Height.—The effect of varying degrees of hookworm intensity on normal increase in standing height is shown in Tables 3 and 4. The distribution by age and by intensity of infestation is the same as that of the weight tables. The children in their stocking feet were measured in inches. Chart 2 gives four graphs, which have the same arrangement as those of Chart 1. In this instance the curves for the boys are used. Graph A compares the growth curve of white boys without hookworms with Clark's standards for white boys. The two curves are very similar. Graph B compares the growth of the lightly infested groups (from 1 to 100 hookworms) with the standard. These curves also coincide. Graph C compares the moderate and heavy infestation groups with the standard. In these groups, as one would anticipate, there is a definite retardation of growth in height, particularly in the older children. Graph D, taken from Table 4, is a comparison of the rate of growth of the group of negro children negative on hookworm examination, with that of children of Groups 2 and 3, who have a hookworm infestation of from 1 to 100 worms. There is no variation in the rate of growth of the lightly infested children from the rate of growth of normal children.

These tables indicate that a heavy hookworm infestation, or even a moderate infestation of 100 to 500 hookworms, causes a definite retardation in the physical development of children. The effects are more marked in the older age groups. This probably does not represent a greater susceptibility in the older children, but is due to cumulative effects, for these children have been infested for a longer period than the younger age groups.

The children in the lightly infested groups, both white and negro, show no variation in their rate of growth from the noninfested children. This seems to indicate that light degrees of hookworm infestation (from 1 to 100 worms) have no measurable effect on the normal rate of growth in height.

Stem Length or Sitting Height.—The children were measured for stem length in accordance with the method used by Dr. Clark in his studies of school children in the United States. No standards were available for southern white children. Clark, Sydenstricker, and Collins [3] (1923) have measured 9,973 white school children from both northern and southern states, dividing them into groups according to their nutrition. We have compared our children with their group of "good to excellent" nutrition. A summary of the analysis of the mean stem length of children having varying intensities of hookworm infestation is given in Tables 5 and 6. Chart 3 gives four graphs arranged

in the same manner as those in Chart 1. Data for the boys only are given. Graph A compares the negative cases with Clark's tables of children with good nutrition. Our normal children, that is, those not infested with hookworms, did not have as great a stem length as Clark's best nutrition group. Graph B compares the children with light hook-

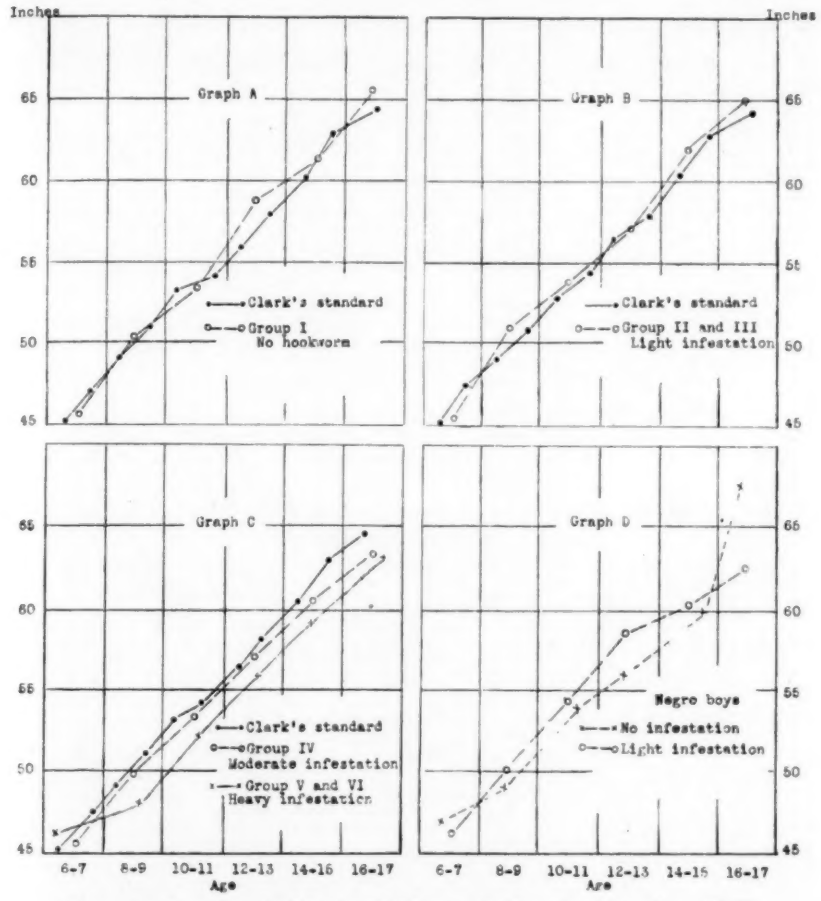

Chart 2.—Standing height in relation to hookworm intensity. Boys.

worm infestations with Clark's standard. This light infestation group approximates Clark's standard more closely than did the negative cases.

Graph C compares the moderate and heavy infestations with Clark's standard. These groups are below Clark's standard for children with good nutrition. They are also below Group 1, that is, normal cases of our series. This retardation of growth in stem length is most marked in the older age period of the group with heavy infestation, but is also quite definite in Group 4, or those with moderate infestation. In Graph

D, the negro children with light hookworm infestations are seen to have a very similar stem length curve to that of the normal negro children. The group lightly infested apparently has a slightly greater stem length than normal children, but the difference is not significant. One

TABLE 5.—*Mean Stem Length in Centimeters in Relation to Hookworm Intensity in White Children*

Age, Years	No Hookworms		Light Infestation, 1 to 100 Worms		Moderate Infestation, 101 to 500 Worms		Heavy Infestation, 501 to 3,000 Worms	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
6-7	60.17 ±0.3 43 cases	61.2 ±0.34 58 cases	60.7 ±0.67 18 cases	61.05 ±0.69 18 cases	60.84 ±0.48 12 cases	60.1 ±0.39 15 cases	64.10 ±0.69 5 cases	63.0 ±0.52 4 cases
8-9	65.07 ±0.41 84 cases	65.5 ±0.26 80 cases	66.77 ±0.31 40 cases	64.6 ±0.36 46 cases	65.04 ±0.49 26 cases	64.1 ±0.29 22 cases	66.5 ±2.80 2 cases	66.5 ±0.43 4 cases
10-11	68.1 ±0.26 55 cases	69.36 ±0.25 67 cases	68.95 ±0.40 50 cases	68.23 ±0.31 53 cases	69.4 ±0.53 29 cases	69.0 ±0.42 25 cases	68.1 ±1.15 5 cases	67.3 ±0.58 7 cases
12-13	72.6 ±0.36 40 cases	74.33 ±0.33 37 cases	72.7 ±0.53 40 cases	74.76 ±0.42 38 cases	71.97 ±0.56 30 cases	74.0 ±0.44 19 cases	71.0 ±0.83 7 cases	73.9 ±1.4 7 cases
14-15	77.8 ±0.64 37 cases	79.65 ±0.59 26 cases	79.01 ±0.74 27 cases	79.36 ±0.51 30 cases	77.5 ±0.65 22 cases	77.6 ±1.1 9 cases	74.5 ±1.26 9 cases	78.0 ±1.18 4 cases
16-17	85.09 ±0.75 22 cases	80.80 ±0.63 11 cases	83.32 ±0.83 16 cases	81.5 ±0.43 29 cases	82.5 ±0.93 13 cases	80.5 ±1.6 4 cases	82.5 ±0.60 3 cases	

TABLE 6.—*Mean Stem Length in Centimeters in Relation to Hookworm Intensity in Negro Children*

Age, Years	Group 1, No Hookworms		Groups 2 and 3, 1 to 100 Hookworms	
	Boys	Girls	Boys	Girls
6 to 7	60.5 ±0.41 25 cases	60.43 ±0.44 31 cases	61.35 ±0.33 7 cases	62.5 ±0.23 7 cases
8 to 9	62.36 ±0.43 34 cases	64.9 ±0.35 52 cases	64.06 ±0.85 9 cases	65.7 ±0.53 10 cases
10 to 11	66.30 ±0.35 39 cases	68.12 ±0.34 58 cases	69.16 ±0.53 18 cases	68.2 ±0.66 12 cases
12 to 13	70.22 ±0.45 43 cases	72.84 ±0.47 46 cases	71.62 ±0.84 18 cases	71.4 ±0.81 11 cases
14 to 15	74.1 ±0.55 25 cases	76.5 ±0.37 32 cases	75.6 ±1.41 11 cases	75.94 ±0.90 14 cases
16 to 17	78.5 ±0.88 8 cases	79.9 ±0.42 20 cases	83.7 ±0.96 5 cases	78.5 ±0.84 7 cases

striking thing about this graph is that the negro boys are seen to have a definitely shorter stem length than white boys of the same age. The same is true of the negro girls. This factor and certain other factors of physiologic difference between the two races, which are not pertinent to the present discussion, will be taken up in another paper.

The analysis of the measurement of the stem length of these children substantiates our hypothesis that light infestation with hookworms (from 1 to 100 worms) has no measurable effect on the normal development of the growing child. Moderate or heavy infestations produce a measurable check on development.

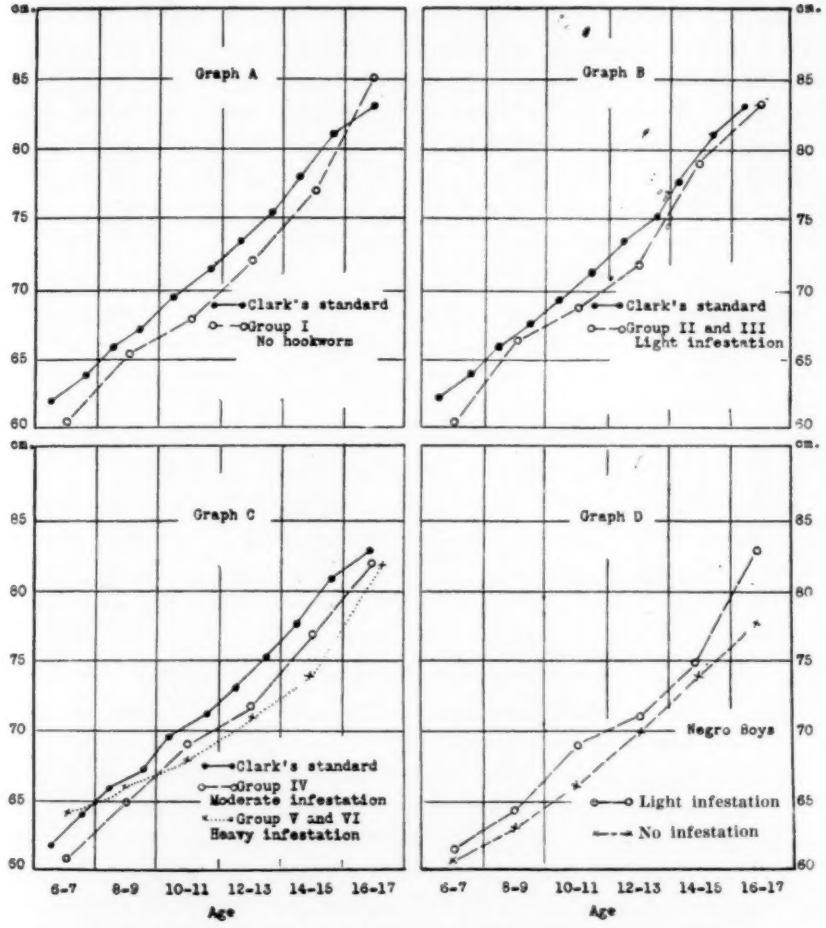

Chart 3.—Stem length in relation to hookworm intensity. Boys.

VITAL CAPACITY

Vital capacity has been widely used as an index of the physical fitness of growing children. Vital capacity is expressed as the amount of expired air as measured by the spirometer. It was felt that this simple procedure might serve as a more accurate index of the injury done to a growing child by hookworms than the measurements of height, stem

length, weight, or even hemoglobin. We used the Sanborn wet spirometer, choosing the highest reading of three trials. The instrument is calibrated in units of 50 c.c.

The vital capacity of a large number of negative and positive hookworm cases from rural south Alabama has been compared with Stewart's standard tables, by Roberts,[6] working in this laboratory. He made no record of the intensity of infestation of the positive cases. He found no correlation between hookworm infestation and lowered vital capacity. We also have been disappointed in our hope that vital capacity would be a useful index in these cases. We have used Stewart's findings for normal white children as the standard of comparison. Group 1 cases (negatives), correspond closely to Stewart's curves for normal children. However, the curves of the moderately or even the heavily infested groups do not show a sufficient deviation from the normal or standard curve to warrant us in concluding that vital capacity is a useful index of the harm caused by hookworm infestation. It is obvious that if there is no definite decrease in the vital capacity in the case of heavily infested children, we could not expect even a slight variation in lightly infested children.

One very interesting point was brought out by the study, however, namely, that the negro children examined had a markedly lower vital capacity than the white children of the same age and sex. This was an unexpected finding and may be of some importance in relation to the lower resistance of negroes to respiratory diseases. So far as we are aware, this physiologic difference in the two races has not been called to the attention of medical science. This question is not pertinent to the subject under discussion and will be considered in a subsequent paper.

HEMOGLOBIN

The hemoglobin has been generally considered as the most delicate index at our disposal in measuring the injury caused by hookworms. It is the index which is always used in hookworm surveys. The clinical picture of hookworm disease is characterized by a severe anemia. Darling, Barber, and Hacker [2] (1920) attempted to estimate the average number of hookworms required to lower the hemoglobin one degree. In the Brazilian studies (Smillie,[7] 1922), one of us found that this was not practicable, as there was a wide variation of the hemoglobin in heavily infested cases. Individuals having ample food and excellent living conditions often had normal hemoglobin despite heavy hookworm

6. Roberts, F. L.: Vital Capacity of Children Infected with Hookworms, Am. J. Pub. Health **15**:774-780 (Sept.) 1925.

7. Smillie, W. G.: Studies on Hookworm Infection in Brazil, Monographs of the Rockefeller Institute for Medical Research, No. 17, May 17, 1922.

infestation. Malnutrition, a poor dietary, overwork, intercurrent malaria and other diseases were important factors which affected the hemoglobin of many of the patients infested with hookworms.

We have excluded from this series all children who have had malaria. The dietary is very similar in all the cases. It is a badly balanced diet, though the children have an ample number of calories. So far as possible, the only variable factor in these children was the intensity of hookworm infestation. The hemoglobins were measured by the Dare apparatus, checked frequently by the Newcomber. Boys and girls were first considered separately, but as the variation in their hemoglobin was slight, both sexes were combined in one group. The age groups were also considered separately, and it was found that the younger children had a slightly lower hemoglobin than the older children. The difference in hemoglobin in the various age groups was so slight, however, that all ages (from 6 to 16) were combined in the final analysis. The correlation between intensity of hookworm infestation and hemoglobin of all the age groups is given in Table 7.

TABLE 7.—*Hemoglobin in Relation to Intensity of Hookworm Infestation in White Children, of All Ages and Both Sexes*

Group	Description	Number in Group	Mean Hemoglobin	Probable Error
1	No hookworms	505	78.28	±0.177
2	Very light infestation, 1 to 25 hookworms	179	74.76	±0.326
3	Light infestation, 26 to 100 hookworms	171	75.66	±0.338
4	Moderate infestation, 101 to 500 hookworms	206	73.4	±0.36
5	Heavy infestation, 501 to 1,000 hookworms	36	66.78	±1.3
6	Very heavy infestation, 1,001 to 3,000 hookworms	28	57.72	±2.05

This table shows that children of Group 2, with very light infestations (from 1 to 25 hookworms), and also those of Group 3, with light infestation (from 26 to 100 hookworms) do not have a lower hemoglobin than negative subjects. In fact, their hemoglobin is slightly higher than those of the normal group. This is due to the fact that a large proportion of the children with no hookworms are in the 6 to 7 year age groups, and these younger children normally have a slightly lower hemoglobin than those of the older age groups. Subjects in Group 4 (moderate infestation) have a slightly lower hemoglobin than those lightly infested, but the definite break in hemoglobin comes only in the groups heavily infested. The negro children have light infestations only. Table 8 compares the group of negro children with no infestation with the group of negro children having light infestation. There is no lowering of hemoglobin in the infested children. The negro children, both normal and infested, have a slightly higher hemoglobin than white children. The reason for this is unknown.

From these data we are justified in the conclusion that light hookworm infestations (from 1 to 100 worms) do not cause a measurable reduction of the hemoglobin of growing children.

COMMENT

These observations bring up many interesting points. We have been able to estimate with some degree of accuracy the actual harm caused to the growing child by severe hookworm infestation, that is, in those harboring 500 or more hookworms. The injury caused by moderate infestation (from 100 to 500 worms) is less marked than that produced by heavy infestation, but is quite definite, particularly in the older age periods. So far as our methods of measurement go, however, we have been unable to determine any decrease in height, weight, stem length, or hemoglobin in lightly infested children, that is, in children harboring from 1 to 100 hookworms.

TABLE 8.—*Hemoglobin in Relation to Intensity of Hookworm Infestation in Colored Children, of All Ages and Both Sexes*

Group	Description	Number in Group	Mean Hemoglobin	Probable Error
1	No hookworms	399	73.45	±0.206
2	Very light infestation, 1 to 25 hookworms	79	76.53	±0.382
3	Light infestation, 26 to 100 hookworms	48	76	±0.512
4	Moderate infestation, 101 to 500 hookworms	18	75.33	±0.533
5	Heavy infestation, 501 to 1,000 hookworms	3 only		
6	Very heavy infestation, 1,001 to 3,000 hookworms	1 only		

The clinical picture of a case of hookworm infestation, as it is usually presented, is that of an undernourished, undersized child, listless and apathetic, with severe anemia, dry skin and scanty hair, edema of the face and legs, shortness of breath, weakness, etc. This picture represents true hookworm disease, and is found when there is an infestation of 500 worms or over. The picture is never seen, however, in children who have a light infestation. Such children are as bright, active, alert, and as well nourished as their companions who have no hookworms at all. They are not anemic, in fact, their hemoglobin is not reduced a single point below normal. So far as we have been able to measure their physical condition, they are normal. Should not these children be considered as carriers, and not as cases of hookworm disease?

The Unciniarisis Commission to the Orient, consisting of Drs. Darling, Barber and Hacker [2] (1920), first began studies as to the effect of varying intensities of hookworm infestation on hemoglobin. They used the exact but tedious method of worm counts as the index to intensity. They found that adults harboring from 200 to 300 hookworms had the same hemoglobin as those harboring from 0 to 25 worms. Only when the infestation was 300 worms or over was there a clearcut

reduction in hemoglobin. In our Brazilian studies (Smillie, 1922), we found that when hookworm infestation was complicated by overwork, by poor and insufficient food, or by other infections, an average of 75 hookworms was sufficient to disturb the balance, and to cause a distinct lowering of the hemoglobin in children and in the aged. Young adults, however, were resistant to much higher infestations. When the average infestation was only 25 hookworms, even the very young children showed no reduction in hemoglobin.

An oft quoted authority for the assertion that light degrees of hookworm infestation cause severe bodily injury is Kofoid (Kofoid and Tucker,[8] 1921), who studied the hookworm infestation of a large number of American soldiers from the southern states in 1917. The positive cases showed very light infestations. Kofoid drew the conclusion that these men with light infestations were much more susceptible to pneumonia and measles than the men with no hookworms, and that the toxic effects of the few worms harbored reduced the mental efficiency of the men about 25 per cent. Kofoid's conclusion would have been more convincing if he had compared groups of men in which light hookworm infestation was the only variable factor. As a matter of fact, the hookworm infestation of the men whom he studied was quite an incidental thing in their lives, a concomitant of previous bad economic and social surroundings. Young adults from the southern states with hookworm infestations come from the remote, isolated rural districts, with a low economic status and inferior educational advantages. These men have been reared under conditions of poverty, with insufficient or badly balanced dietary and poor housing. It would not be surprising if they were found to be more susceptible to pneumonia and measles than the negative subjects, who come from the more advanced towns and villages or the more progressive rural districts, and possess a better economic and social background. If Kofoid had divided his groups according to previous occupations, or if they had been divided according to whether the young men came from towns and villages, or were sons of tenant farmers, the results of this analysis would have been the same, irrespective of the result of the stool examination.

It is probable that more exact and delicate measurements of physiologic differences may be introduced which will show us that even as low an infestation as 25 to 50 hookworms may cause some slight injury to the growing child. We are now undertaking some experiments to determine this point.

From the analysis of the data already presented, however, it seems fair to assume that an infestation with a small number of hookworms

8. Kofoid, C. A., and Tucker, J. B.: On the Relationship of Infection by Hookworms to the Incidence of Morbidity and Mortality in 22,842 Men of the U. S. Army at Camp Bowie Texas, Am. J. Hyg. **1**:79-117, 1921.

causes little harm to the individual, and is not of great economic importance to a community.

There were 178 white children and fifty-five negroes in Group 3 (from 26 to 100 hookworms). These children harbored an estimated average of 54 hookworms each. So far as we were able to determine, these children were not affected to any measurable degree by their infestation. In some of our measurements we combined Group 3 with Group 2 (from 1 to 25 hookworms). There were 215 children in Group 2, harboring an average of 10 hookworms each. The combined Group, 2 and 3, contained 454 children, harboring an average of 33 hookworms each. In none of our measurements were the children of Group 2 and 3 below the measurements of the negative subjects.

We are justified in concluding, therefore, that an average infestation of from 35 to 50 hookworms has no measurable effect on the normal growth and development of the child. To be on the conservative side, however, let us reduce to 25 the maximum number of worms which may be harbored without ill effect. Any child harboring 25 hookworms or less can be considered an economic cure. He may be regarded as a carrier, not as a case of hookworm disease.

Using this figure as a basis, the policy of the public health officer is simple. It has been clearly shown that a single standard treatment will remove from 90 to 95 per cent. of all hookworms harbored, and that two treatments, properly given, will reduce the worms of even a heavily infested subject to less than 25; that is, to the point of economic cure. On the other hand, it is sometimes very difficult and costly to effect a complete cure by treatment. Sometimes five or six treatments are required to eliminate a half dozen refractory worms. There is, moreover, a certain amount of danger attached to hookworm treatment, and it is not only a bad policy, but it is unfair to the subject to submit him to the rigor of treatment beyond the point of economic cure. Treatment, therefore, should be used solely to reduce the degree of intensity of infestation to a point when there is no hookworm disease, that is, to produce an economic cure of a person or of a community, and then to hold it at this point. It is not wise or practicable in public health work to use hookworm treatment for any other purpose.

Elimination of the carriers can only be accomplished by sanitation and education. It is obvious that sanitation and education can be used effectively as the sole weapons of offense, and, in time, these methods will eliminate both the disease and the carrier, but this method is very slow. It is a more economic and humanitarian policy to use treatment to control disease; sanitation and education to eliminate the carriers.

SUMMARY

If we accept these general principles in regard to hookworm control, then the general plan of the public health administrator in initiating control measures would be as follows:

1. He should first determine the mean temperature and rainfall throughout the year for the area in question. He should then make studies of the types of soil within the area, determining with the aid of the Baermann isolation apparatus whether hookworm larvae can readily develop to the infective stage in these soils. These preliminary observations, together with a brief study of the economic status and the sanitary habits of the inhabitants, will enable him to estimate with considerable accuracy the economic importance of hookworm disease to the community.

2. The next step should be a preliminary survey of the area to determine the intensity of hookworm infestation. Examination of about 10 per cent. of the population will give a very fair indication of this, if various ages, occupations, races, and social groups are included. The stool examinations may be done by the salt flotation method, and a Stoll ova count may be made on all positive cases.

If the average intensity of the infested persons in a given community falls into Group 2, or into Groups 2 and 3, then no treatment need be considered, since there is no true hookworm disease in the area, and sanitation and education will easily control the situation.

If the average intensity is high, the majority of the persons examined falling in Group 4 (from 100 to 500 worms), with a considerable proportion in Groups 5 and 6 (over 500 worms), then the area has real hookworm disease, and treatment should be employed. One standard treatment [9] can be administered to all patients moderately infested, two treatments to the heavily infested subjects, with the assurance that this measure will reduce the average intensity to the point of economic cure. Only sanitation and education can permanently hold it at this point.

But reinfestation is slowly acquired, and even if no sanitary measures at all are instituted, a considerable period of time will elapse before it is necessary to give another course of treatment. The length of this time interval depends on the degree to which the factors which influence the development of hookworm larvae in the soil are favorable or unfavorable, and the facilities which the larvae in the infective stage may have for reaching the human host.

The Stoll method of ova counts is sufficiently accurate in estimating the average intensity of infestation to determine whether or not a com-

9. A standard hookworm treatment is considered as one which will remove 90 to 95 per cent. of all hookworms harbored at a single administration. The effective doses for thymol, betanaphthol, oil of chenopodium, carbon tetrachlorid and ascaridol have been determined.

munity has a real hookworm problem, and also may be used to determine when actual hookworm disease is under control.

Persons with light infestations whose few hookworms are causing them no real harm, need not be subjected to the discomfort of a vigorous hookworm treatment. Time and effort formerly expended for unnecessary hookworm treatment may be devoted to the permanent control of the carrier by means of sanitation and education.

A plan for hookworm control such as we have suggested may be adapted to the needs of any community. Hookworm disease can readily be reduced to a minimum without employment of a large personnel, and without the great expenditure of public funds that is required when an attempt is made to treat all subjects so infested until they are free from ova.

CONCLUSIONS

1. Heavy hookworm infestation (500 *Necator americanus* or over), causes marked retardation in the normal growth in height and weight and lowers the hemoglobin of children of school age. An intensity of from 100 to 500 hookworms also produces measurable injury. Such intensities of infestation should be regarded as true hookworm disease.

2. Light hookworm infestation (from 1 to 100 *Necator americanus*) produces no measurable retardation in the normal development of children of school age, nor is the hemoglobin of this group reduced to a measurable degree.

3. An infestation of 25 *Necator americanus* may be considered as the economic base line of cure. An infestation of 25 worms or less represents a carrier state, and is not true hookworm disease.

4. Sanitation and education should be relied on to control the hookworm carrier. Hookworm treatment should be used only in cases of true hookworm disease.

5. The Stoll ova count method is a reliable measure of the intensity of hookworm infestation.

6. These conclusions apply only in areas in which *Necator americanus* is the principal infesting agent.

FASTING AS A CAUSE OF CONVULSIONS*

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The onset of acute infections in young children, especially in those under 3 years of age, is particularly likely to be attended by convulsions. Infantile eclampsia and spasmophilia are terms that have been used to cover ignorance of the true cause. The latter term implies a recognition of the further observations that certain children are especially susceptible to this type of convulsive seizure, so that in them the convulsions may be said to be of a recurrent nature. Moreover, it is well known that these convulsions offer a relatively good ultimate prognosis, in other words, that the child will "out-grow" them. Undoubtedly, many of these attacks are manifestations of tetany, especially those occurring in rachitic children in the first 2 years of life. Others are due to actual lesions of the brain, congenital or acquired, and these are usually associated with some degree of mental retardation. Idiopathic epilepsy would account for relatively few before the age of 4 years. It is my purpose here to call attention to a group of children with convulsions which have as their basis a short period of fasting, so short indeed that one hesitates to call it fasting.

Those who have been in hospital positions in which they are likely to be called at any hour to see a sick child must have had this experience more than once, and have wondered at the apparent perversity which makes children seem to choose 5 or 6 a. m. to exhibit symptoms that may not be ignored. One might suspect that the occurrence of convulsions in the early morning is a matter of pure chance, but when one sees that there are children who have recurring attacks of convulsions, and that the onset in each instance is in the early morning, before breakfast and not after, at night only when the child has missed his supper, after a meal only when he has vomited that meal, then suspicion is aroused and one is inclined to turn to a study of short fasting periods in a search for the explanation of the convulsions.

The direction that this study was to take was furnished by a case that S. G. Ross and I [1] studied some time ago and reported in October, 1924. In brief, the case was that of a child, L. S., who was subject from the age of 6 months to frequently repeated attacks of vomiting accompanied by convulsions, occurring each time at the onset of an acute

* Received for publication, Aug. 25, 1925.

* From the Harriet Lane Home for Invalid Children, and the Department of Pediatrics, Johns Hopkins University.

1. Ross, S. G., Josephs, H. W.: Observations on the Metabolism of Recurrent Vomiting, Am. J. Dis. Child. **28**:447 (Oct.) 1924.

infection. The blood sugar during one of these attacks was found to be 0.037 per cent. It was noted at the time of our study that the attacks commenced invariably in the morning at about 7 o'clock.

The case histories that follow have been chosen for collection on the basis of certain conditions. The convulsions must in all cases follow a fasting period of at least ten or twelve hours. As the association of convulsions with a short fasting period may be a matter of mere coincidence, it has seemed best to demand recurrence of the convulsions as one of the criteria, except in those cases in which the relationship with hypoglycemia is made clear in other ways. The child must be mentally normal, and between attacks he must be entirely normal without any symptoms that can suggest the possibility of epilepsy.

CASE HISTORIES

CASE 1.—R. C., a boy, was born in January, 1921. The family history was negative.

Past History.—The child was born by breech extraction and was cyanosed at birth. He breathed well, however, after a few minutes and nursed normally. He had no convulsions. He had a mild attack of pertussis at about 6 months, but otherwise had been well and had developed quite normally up to 2½ years of age.

Present Illness.—Repeated attacks of convulsions began in June, 1923, when the child was about 2½ years old. The first attack was mild, lasting only a few minutes. The onset was in the morning before rising, and so far as the mother knew was unassociated with fever. The child had been well the night before. There was no vomiting or drowsiness, and recovery was prompt.

The second attack, in September, 1923, was more severe; the onset was in the morning before rising, but recovery was not so prompt and the child remained somnolent throughout the day. There was no fever or vomiting.

The third attack was in January, 1924, and was also severe. Like the former attacks the onset was before rising. A prolonged period of somnolence followed the convulsion and the child was brought to the hospital. There he remained drowsy and in a position of opisthotonos. The temperature was 102 F. The spinal fluid was negative. The boy remained drowsy the following day and then recovered completely. Since that time the child has remained well and has had no more attacks of convulsions. He was always well between attacks, and is rather above the average both physically and mentally.

CASE 2.—R. R., a boy, colored, was born in April, 1918. The family history was negative.

Past History.—The child developed normally. His only illness was pertussis when he was about 4 years of age. The Wassermann reaction was negative.

Present Illness.—The boy had repeated convulsions. The first attack occurred when he was 1 year of age. The onset was in the early morning before food was given. The convulsions were mild, and were followed by a period of drowsiness lasting for about twenty-four hours. There was fever but no vomiting. At 2 years of age the child had an exactly similar attack. At 5 years he had a third attack which came on at night (time was not stated), and was repeated the following morning. A period of drowsiness and delirium lasting about twenty-four hours followed. As in the others, there was fever but no vomiting. At 6½ years the child had his fourth attack, which like the others came on in the early morning and was characterized by drowsiness and fever lasting about twenty-four hours. Three months later he had a fifth attack, this one occurring at 10 p. m., after the child had played all the afternoon and gone to bed without

supper. This was a milder attack than the others, and the child was well the next morning. There was no fever during this attack.

On examination, the child was found to be mentally normal. The attacks always came on without warning, and there was nothing characteristic of epilepsy about them.

CASE 3.—E. C. B., a boy, white, was born in June, 1922. The family history was negative.

Past History.—The child was born normally and there was no early history of convulsions. He had had numerous colds with attacks of otitis media, but no serious illness. His development was normal. The Wasserman reaction was negative.

Present Illness.—The boy had had repeated convulsions. From September, 1923, to September, 1924, he had five attacks of convulsions all of a similar nature. Each attack began with fever and vomiting, followed after twenty-four hours by convulsions which were usually repeated once or twice in the course of the next forty-eight hours, during which time the child continued to vomit and became rather drowsy. He would then recover spontaneously and remain quite well until the next attack. The attacks occurred regularly every three months. The spinal fluid was negative with each attack. On examination, no cause was found for the convulsions. The child's head was large but not hydrocephalic, and he was unusually intelligent for his age. The calcium content of the serum was normal.

CASE 4.—G. M., a boy, white, was born in July, 1923. The family history was negative.

Past History.—The child was born normally and there was no early history of convulsions. He had a rather mild attack of pertussis in the summer of 1924, and during the attack he had a convulsion, the details of which could not be obtained.

Present Illness.—This began with convulsions. During the winter of 1924-1925, the child had colds occurring about once every month or six weeks. Convulsions occurred at the onset of each attack. These convulsions began each time in the morning before breakfast, lasted five or ten minutes and were repeated once or twice in the course of the next hour. Then the child seemed better and by the afternoon had recovered completely. There was no vomiting.

On examination between attacks, the child was found to be mentally and physically quite normal.

CASE 5.—W. A., a boy, colored, was born in April, 1922. The family history was negative.

Past History.—The birth and development were normal. During the first 2 years of life the child had "spells" which seem to have been "breath-holding" attacks. The Wassermann reaction was negative.

Present Illness.—This began with convulsions. In October, 1924, at the age of 2½ years, the child one night refused supper after playing all the afternoon. The next morning before breakfast he had a convulsion lasting for about fifteen minutes. He was immediately brought to the hospital where he had another convulsion. It was found that his breath contained considerable acetone, on bubbling a sample of expired air through Scott-Wilson reagent. He remained somnolent until the next morning, when he slowly recovered. His temperature was 104 F. Since that time the child has had no similar attack, and has had nothing to suggest petit mal. He is mentally normal.

CASE 6.—E. W., a girl, white, was born in August, 1919. The family history was negative.

Past History.—The child had a normal birth and development. She had measles, pertussis, scarlet fever and varicella. In October, 1924, she had meningitis and recovered from this completely in seven weeks, after serum treatment.

Present Illness.—The child had convulsions. In December, 1924, at the age of 5 she had her first attack. The onset was in the morning before breakfast, when she had a convulsion accompanied by vomiting, fever, and marked drowsiness. She remained drowsy and feverish for three or four days thereafter, but there was no repetition of the convulsion.

Her second attack, similar in every way to the first, occurred in April, 1925. She was seen at the hospital a week after this second attack at which time she had recovered completely. Between attacks she is perfectly well, is intelligent, and without evidence of epilepsy. Moreover, there is no evidence that her attacks are a sequel to the meningitis, beyond the fact that her first attack followed shortly after her recovery from meningitis.

CASE 7.—W. S. H., was born in May, 1921. The family and past history were negative.

Present Illness.—The child has had two attacks of convulsions, each one at the onset of an acute infection and occurring in the early morning before breakfast. The first was in December, 1924, the second in February, 1925. The duration of convulsions was about ten minutes each, and with the second attack the convulsions were repeated on three consecutive mornings. The child was seen a few weeks after the second attack and was found to be quite normal on physical examination.

As I have said, an extensive study of one child, L. S., led to a belief that hypoglycemia might possibly be the cause of this type of convulsion. Since 1922, when our last studies were made, L. S. has had two attacks a year exactly similar to his earlier ones except that they have not been so severe. They have always occurred at about 7 o'clock in the morning, have been accompanied by vomiting and with one exception by fever. This one attack was initiated by a somewhat more prolonged fasting period, for the child was allowed to go without his supper after playing hard all the afternoon, and the attack commenced the next morning. In the course of the last two years, three other children have been studied sufficiently early in an attack to allow of a definite diagnosis of hypoglycemic convulsions.

CASE 8.—S. E., a girl, white, was born in April, 1916. The family history was negative.

Past History.—The birth and development were normal. The child has had measles, mumps, varicella, pertussis and frequent attacks of tonsillitis.

Present Illness.—Vomiting and convulsions. Since infancy the child was subject to attacks of vomiting which occurred every three or four months, especially in the winter. These, from the description furnished by the mother, appear to be typical attacks of recurrent vomiting of a rather mild character, in that they seldom lasted longer than two or three days, although during their progress the child vomited everything taken by mouth and appeared to be very ill.

In February, 1924, she began to vomit after attending a party at which she had apparently overeaten. Shortly after vomiting she had a convulsion which lasted about fifteen minutes. The convulsion was repeated the next morning. Thereafter the vomiting ceased and the child made a rapid recovery.

Her second convulsion occurred in May, 1924. She awoke at 3 a. m. complaining of being sick and shortly afterward began to vomit. At 11 o'clock she had a generalized convulsion and became unconscious. She remained in this state all day and when seen at 9 p. m. was unconscious and delirious, lying in a position of opisthotonos, with stiff neck and positive Kernig's sign. Her temperature was 104 F. When admitted to the hospital she had recovered con-

sciousness and was vomiting profusely. Her blood sugar was found to be 0.065 per cent. Glucose was given by rectum and by the next morning she had ceased vomiting and was quite rational. Acetone was present in the urine in large quantities on admission. Signs of consolidation appeared at the left base. The pneumonia thereafter ran an uneventful course and the child had recovered completely in a week.

Another attack without convulsions occurred in January, 1925. She started to vomit in the morning on rising and was immediately taken to the hospital where glucose was administered by rectum, with prompt recovery. Since that time her mother has aborted two more attacks by prompt use of sugar solution, so that now she has had no vomiting for six months in spite of two attacks of tonsillitis.

CASE 9.—N. H., a girl, white, was born in May, 1923. The family and past history were negative.

Present Illness.—The child had vomiting attacks and convulsions. She had two attacks of vomiting, the first at 18 months, the second at 23 months. Both started without warning at about 7 a. m., lasted for two or three days and then ceased. Between attacks the child was well.

On May 1, 1925, she had fever and refused her food in the evening. The next morning she was playing normally before breakfast when she suddenly had a convulsion. She was brought to the hospital, where she had two more convulsions. Her blood sugar was 0.060 per cent. She was very drowsy and she continued in this condition until the next day, when glucose solution was given by mouth in small, frequently repeated doses. She recovered about four or five hours after the administration of glucose was started. In this attack there was no vomiting.

CASE 10.—R. H., a boy, was born in January, 1923. The family and past history were negative.

Present Illness.—On July 1, 1925, after playing normally all morning, the child was found at 12 noon lying on the floor very drowsy. He was feverish and drowsy all that day. For the next two days he remained drowsy and feverish and vomited everything that his parents attempted to give him. On July 4, he had a "spasm" in which he became stiff for about five minutes. The urine was scanty. Later in the day, when the child was brought to the hospital, the depth of breathing was somewhat greater than normal, suggesting the beginning of acidosis. On admission his blood sugar was 0.058 per cent.; acetone was found in his breath in considerable amounts; the carbon dioxid capacity of his serum was 35 per cent. by volume. He was given glucose in small, frequently repeated doses by mouth throughout the night. He retained the glucose given in this way and by the next morning was able to take food again.

COMMENT

The attacks, it may be noted, followed very short fasting periods, the periods in general being no longer than the usual one from supper to breakfast. It seemed of interest, therefore, to determine the rate at which the blood sugar concentration would diminish during just such a short period in children subject to convulsions and in a sufficient number of normal children to establish the normal limits of this fall. It may be recalled that in the case of L. S. it was found that the blood sugar concentration fell more rapidly than it did in a group of epileptic children who had been fasted. The method employed to determine the alteration of sugar concentration follows: The child is given a light supper at 5 o'clock. Three and half to four hours later a sample of blood is obtained from the finger and from an arm vein and the sugar

is estimated by a modified Bang method. The next morning another sample is obtained before the child has had breakfast, which is delayed purposely until about 10 o'clock. The results of this study will be published separately. In this paper only results obtained with blood from the finger capillaries will be used.

Briefly, it may be said that about thirty children have thus far been studied; some, normal children who have entered the hospital for tonsillectomy; others, children convalescent from acute infectious disease. The ages have varied from 2 to 12 years. In this group of normal children the blood sugar concentration after sixteen hours' fast was only slightly if at all below that obtained four hours after a meal. The maximum fall was about 0.015 per cent. (15 mg. per hundred cubic centimeters). I have been unable to study more than four children whose histories are reported here, but in these the results are striking. Not only was the fall in blood sugar concentration more rapid, but the final concentration was lower than in normal children. In G. M. (Case 4) the fall was from 0.103 to 0.073 per cent.; in W. A. (Case 5), from 0.105 to 0.070 per cent.; in S. E. (Case 8), from 0.110 to 0.077 per cent. and in R. H. (Case 10) from 0.096 to 0.078 per cent.

RELATION TO RECURRENT VOMITING

Vomiting took place in a number of the cases and in some it overshadowed the convulsions to such an extent that I have classified the cases under "recurrent vomiting" (compare L. S.; S. E.; E. C. B.; R. H., and N. H.). The occurrence of convulsions in attacks of recurrent vomiting has been described before. The first report of recurrent vomiting in this country was that of Snow [2] in 1893. The recurrent attacks of vomiting and convulsions with which the child suffered are somewhat similar to the ones reported here. Marfan,[3] in his recent review of recurrent vomiting, speaks of convulsions as sometimes occurring during attacks, and occasionally replacing attacks of vomiting, but offers no references. I have been able to find in the literature only three instances in which convulsions occurred shortly before death in fatal attacks.[4] In the records of the Harriet Lane Home I have found two cases of recurrent vomiting in which convulsions took place during one of the attacks. It is of interest that in one of these cases the child had had virtually nothing to eat for twenty-four hours preceding the onset of vomiting and convulsions.

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2. Snow, I.: Arch. Pediat. **10**:986, 1893.

3. Marfan, A. B.: Les vomissements périodique avec acetonémie, Paris, 1921.

4. Meyers, A. W.: Arch. Pediat. **24**:914, 1907. Jones, E. C.: Arch. Pediat. **26**:446, 1909. Dorlencourt: Bull. Soc. de Pédiat. Paris **4**:281, 1921.

There seems to be much evidence accumulating that recurrent vomiting in many cases is dependent on hypoglycemia (Hilliger,[5] Knoepfelmacher,[6] Schloss,[7] Ross and Josephs,[8] and other cases as yet unreported). Moreover, I have recently shown that hypoglycemia is probably responsible for the attacks of vomiting that occur after general anesthesia.[9] It would appear probable, then, that attacks of recurrent vomiting and the convulsions described in this paper are both manifestations of the same condition.

FEVER

Fever was present in most of the cases reported here, but apparently was not necessary for the production of convulsions. The significance of the fever is probably twofold. In the first place, anorexia almost invariably accompanies the acute infections of childhood, and this anorexia may easily account for a period of fasting. The second effect of the fever is rather hypothetic. For some reason, which can hardly be discussed at this time, these children seem unable to mobilize their carbohydrate as rapidly as it is needed, with the result that the concentration of sugar in the blood falls. Fever, together with a short fast, has the effect of producing an attack, when simple fasting for the same length of time merely causes a lowering of the blood sugar. Fever may either have an effect on the metabolism by diminishing mobilization of carbohydrate or, as seems quite probable, by increasing the rate at which the available carbohydrate is used up, or else it may merely render the child's nervous system more unstable so that a lowered concentration of sugar in the blood, which under ordinary conditions causes no disturbance, would cause convulsions at the higher temperature.

CONVULSIONS

Except for the low figure in the case of L. S. (0.037 per cent.), as before-mentioned, the blood sugar concentration has not been found to be excessively reduced (0.06 per cent. in N. H. during convulsions, 0.065 per cent. in S. E. ten hours after a convulsion, 0.058 per cent. in R. H. shortly after a convulsion). On the other hand, in other cases blood sugar concentrations of 0.06 per cent. and lower were not attended by convulsions. In L. S. a blood sugar concentration of 0.045 per cent. was reached without convulsions. Evidently then there is nothing that might be called a "level" at which convulsions occur as there is with rabbits under the influence of insulin.

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5. Hilliger: Jahrb. f. Kinderh. **80**:1, 1914.
6. Knoepfelmacher: Monatschr. f. Kinderh. **21**:241, 1921.
7. Schloss: Thirty-Sixth Annual Meeting of the American Pediatric Society, Am. J. Dis. Child. **28**:251 (Aug.) 1924.
8. Footnote 1.
9. Josephs, Hugh: Bull. Johns Hopkins Hosp., in press.

The duration of the convulsions was, in general, short—from ten to fifteen minutes—but sometimes they were repeated on the same day or even on successive days. As a rule, especially in the younger children and in first attacks, recovery took place rapidly, usually after a period of drowsiness. It is noteworthy, however, that those attacks in which vomiting took place were apt to be more severe and of longer duration. The convulsions frequently consisted of nothing more than a stiffening of the body. In general, however, there was nothing in their character to differentiate them from convulsions due to other causes.

ACETONE BODIES

Acetone bodies have been found early in the attack in those cases which have been studied sufficiently early, but their significance is not very great for diagnosis. Acetone bodies are often present in the breath and urine of children very early in the course of infections, whether the blood sugar concentration is high or low, so that for this reason even their early appearance is of doubtful value in diagnosis, however great their value may be in the consideration of the etiology.

No studies of acidosis were made except in the case of L. S., and these have already been reported. That actual acetone body acidosis might have been present is indicated by the observation of some degree of hyperpnea in three of the cases reported (W. A., N. H. and R. H.).

DIAGNOSIS

Little need be said of diagnosis until the limits of this condition are defined with greater accuracy than is possible at the present time. I think that probably I have been too conservative in the selection of cases to be included in this category, for I have virtually excluded first attacks, attacks in which the fasting period was shorter than ten hours, attacks in mentally deficient children in whom it was impossible to exclude epilepsy. An important point naturally is the finding of hypoglycemia; but the chief difficulty in the way of this is the rapidity of recovery as well as the length of time that has elapsed before the children are first seen. Often, unless the blood sugar determination is made within the first few hours of the attack, the figures may mean nothing. On the other hand, one cannot say that merely because hypoglycemia is present, the convulsions are necessarily due to it. Repetition of the attack in all its essentials is of great help. The therapeutic test—rapid recovery after administration of glucose—is useful only when the child has shown no tendency to spontaneous recovery, as in the case of N. H. (Case 9). As spontaneous recovery is the rule, the therapeutic test has a very limited application. Finally, the test I have described—by which the fall in blood sugar concentration during a sixteen hour fast is determined—may prove to be of value; it is as yet too soon to offer it as a specific test for this condition.

SUMMARY

In this paper, attention is called to short fasting periods as a cause of convulsions in children, especially that type of convulsion which is seen at the onset of acute infections. Studies carried out on several of the children who have come under observation indicate that these convulsions are probably of hypoglycemic origin. Attention is called to the close association of this type of convulsion with the attacks of recurrent vomiting. This is a clinical study and no attempt has been made to discuss the mechanism of the hypoglycemia or the significance of the acetonemia that accompanies the attacks.

INTRACUTANEOUS TESTS WITH HUMAN AND WITH BOVINE TUBERCULIN *

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Detre,[1] in 1908, proposed a modification of Pirquet's cutaneous reaction for tuberculosis. He suggested that simultaneous tests be made with bovine and with human tuberculin; in this manner, it might be possible to determine not only the presence or absence of tuberculosis, but also the type of the infecting organism.

Following this suggestion, several articles were published by different authors from various localities, in which data were given as to the relative frequency of positive reactions with each type of tuberculin. Table 1 shows a tabulation of these findings.

TABLE 1.—*Relative Frequency of Positive Reactions*

Authors	Date	Human Tuberculin + Bovine Tuberculin 0	Bovine Tuberculin + Human Tuberculin 0	Both Tuberculins Positive		
				Human More Strongly Positive	Human and Bovine Reactions Equal	Bovine More Strongly Positive
Heim and John (Wein. klin. Wchnschr. **21**: 252)	1908	30 (?)	0	12	14	35
Clarke and Forsythe [4]	1910	5	5	36	72	38
Vivaldi (quoted by Cattaneo)	1910	7	0	11	14	2
Klose (Deutsch. med. Wchnschr. **36**: 2239)	1910	7	4	32	22	10
Maggiore [2]	1912	3	0	5	27	3
Cattaneo (Ztschr. f. Kinderh **6**: 506)	1913	7	2	11	14	0
Bernheim-Karrer (Schweiz. med. Wchnschr. **50**: 10)	1920	7	3	41	84	8
Kretschmer (Deutsch. med. Wchnschr. **47**: 465)	1921	22	6	28	14	6
Symboldt (quoted by Kretschmer)	1920 (?)	1	28	0	6 (?)	4

Analysis of the figures in Table 1 shows that there were many patients who reacted only to one type of tuberculin. A majority of the investigators found that the human tuberculin gave more positive reactions than the bovine tuberculin. The predominance of human reactors in one series and of bovine reactors in another may be explained either by the prevalence of human tuberculosis in one city and of bovine tuberculosis in another city, or by difference in the potency of the tuberculin used.

* Received for publication, Oct. 6, 1925.

* From the Department of Pediatrics, University of Cincinnati.

1. Detre: Differentielle Tuberkulinreaktionen, Wien. klin. Wchnschr. **21**: 173, 1908.

Maggiore [2] made Pirquet tests, using human, bovine, avian, fish and reptile tuberculins, and a tuberculin made of the pseudotubercle bacillus of Rabinovitch. In no case did any of the other tuberculins give a stronger reaction than either the human or the bovine tuberculin.

Practically all of the articles quoted show an endeavor to classify the location of the tuberculous lesions with the type of tuberculin reaction, but no consistent results were found.

Hermann [3] followed several cases of tuberculosis over a period of from four to five years; in summarizing her own work and that of others, she drew the following conclusions:

1. A small number of cases react on repeated skin tests to only one of the two tuberculins, namely, old and bovine.
2. If one repeats the skin test often enough, one finally gets a double reaction.
3. We believe that in these cases, the body possesses, first, a specific reaction against the exciter of the trouble, and later develops reaction against the whole group of tubercle bacilli.
4. A similar condition of cutaneous sensitivity is found also in persons whose allergy is dying out.
5. In both cases, so far as one can tell without bacteriologic proof, one seems justified in diagnosing the type of inciting organism from the skin reaction.
6. When, on clinical observation, an individual shows an active and not extensive process, one can conclude that there is a beginning immunity, if one tuberculin test shows a distinctly more active reaction than the other.
7. After ruling out technical errors through repetition, and after considering the clinical aspects of the case, one can accept the predominant skin reaction as a proof of the type of infecting agent.

Clarke and Forsythe [4] found that nearly every patient with tuberculosis reacted to both bovine and human tuberculin. Therefore, they reasoned that perhaps both types of organisms were present and that when patients are to be treated with tuberculin, a mixed bovine and human tuberculin should be used.

The Pirquet skin test has proved of great value in the diagnosis of tuberculous infection in children. According to the usual interpretation, a positive reaction signifies that the patient either has an active tuberculosis or has had one at some time. A negative reaction is not so conclusive as negative evidence of present or past infection with tuberculosis, but might also happen (*a*) when the tuberculosis infection is overwhelming, as in many of the cases of acute miliary tuberculosis and of tuberculous meningitis; (*b*) when the patient has a severe intercurrent infection, such as measles or influenza, and (*c*) in a certain proportion of tuberculous patients who on repetition of the test may show a posi-

2. Maggiore: Contributo alla Teoria dell' unicismo tubercolare nei Rapporti colla Pathologica umana, Pathologica **4**:317, 1912.

3. Hermann: Beitrage zur differentialdiagnostischen Verwertung der kutanen Tuberkulinreaktion, Jahrb. f. Kinderh. **86**:472, 1917.

4. Clarke and Forsythe: The Differential Cutaneous Reaction in Tuberculous Diseases, Brit. M. J., 1910, p. 1348.

tive reaction. A negative Pirquet reaction in a suspicious case should indicate several repetitions of the test, before one can feel even partially satisfied that tuberculosis should be excluded. At the present time in many of the clinics of the United States, the Pirquet test has been superceded by the intracutaneous method, in which a diluted tuberculin (usually 1 : 1,000) is injected. This procedure detects a much higher percentage of tuberculous cases. In our experience, about 95 per cent. of the miliary and meningitic cases give positive intracutaneous reactions, and practically no patient gave a positive reaction following a negative test, when the repetition was done inside of two weeks. The intensity of the reaction will often vary with the lot of tuberculin used. Even allowing for this fact, patients with definitely proved tuberculosis will not infrequently have negative skin reactions. Several such cases occurred in our service, and led us to make simultaneous tests with bovine and with human tuberculin.

During the last year, we have been making routine skin tests with both types of tuberculin on children admitted to the pediatric service of the Cincinnati General Hospital, using Koch's old tuberculin for the human tuberculin test, and bovine bouillon filtrate (Parke & Davis) for the bovine. The intracutaneous method was employed, 0.1 mg. of tuberculin, or 0.1 c.c. of a dilution 1 : 1,000, being used and a control test done with salt solution.

The results from fifty-one cases showing positive reactions are given in Table 2.

TABLE 2.—*Results in Fifty-One Cases*

Reaction to human tuberculin alone	3
Reaction to bovine tuberculin alone	8
Reaction to both, but more markedly to human tuberculin	6
Reaction to both, but more markedly to bovine tuberculin	14
Reaction to both with same intensity	20
	51

Of the fifty-one cases of tuberculosis, eight, or 16 per cent., gave a negative reaction with an intracutaneous test with old tuberculin. It, therefore, appears that the value of the tuberculin test is increased, if the test is made with both human and bovine tuberculin, either in separate tests or combined, as suggested by Koopman.[5]

CASE REPORTS

CASE 1.—*History.*—A boy, white, well developed, was admitted to the General Hospital on Nov. 1, 1923, because of a lump in the left groin. Three months previously to this, he had a puncture wound of the left heel from a nail: a tender area developed and one week later the wound was opened and a half

5. Koopman: Diagnostiche Oberhautimpfungen mit Alttuberkulin Koch und Perlsuchtstuberkulin in einen Privatschule, Med. Klin. **19**:1193, 1923.

teaspoonful of pus was released; the wound healed promptly. The lump in the groin had been slowly increasing in size for the past month.

Physical examination showed a confluent enlargement of the longitudinal lymph glands of the inner side of the left thigh; the center of the mass was fluctuant. The patient's temperature on admission was 100.6 F., and a white blood count showed 11,000 cells of which 82 per cent. were polymorphonuclears. The human tuberculin test was negative; nevertheless, a diagnosis of tuberculous glands was made. The glands were excised, and sections of them showed pathologic changes characteristic of tuberculosis. Recovery was complete and uneventful. Further tuberculin tests were made, as noted in Table 3.

TABLE 3.—*Tuberculin Tests* *

Case 1	Nov. 1, 1923	Nov. 17, 1923	Nov. 26, 1923	Feb. 27, 1924
Human tuberculin.....	Negative 0.2 mg.	Negative 0.4 mg.	Not done	Slightly positive 0.3 mg.
Bovine tuberculin.....	Not done	Not done	Markedly positive 0.3 mg.	Markedly positive 0.3 mg.

* The figures represent the quantity of tuberculin used.

Comment.—This patient developed tuberculous adenitis, the bacilli entering through a wound of the foot. The infection seemed to be with bovine tubercle bacilli. Seven months after the onset of the infection, the patient was beginning to show a group immunity, as indicated by a slightly positive reaction to human tuberculin.

CASE 2.—*History.*—A boy, white, aged 11 years, was admitted to the hospital on Oct. 25, 1923. In July, 1923, he had had whooping cough and received a series of five injections of pertussis vaccine into the extensor surface of each arm, the arms being alternated at each dose. One week after the last injection, a swelling was noticed in the left axilla. This broke down and discharged purulent material but later healed. A similar swelling appeared in the right axilla and also broke down, but failed to heal. There was no history of exposure to tuberculosis.

The boy was pale and poorly nourished; in the right axilla there was an ulcer about the size of a half dollar which showed no tendency to heal. In spite of a negative tuberculin reaction, a diagnosis of tuberculous adenitis was made. The glands were excised and showed gross and microscopic pathologic changes characteristic of tuberculosis; tubercle bacilli were found in a stained section of the gland. The local lesion healed, and the boy was transferred to an institution for the potentially tuberculous child. Further tuberculin tests were made, as shown in Table 4.

TABLE 4.—*Tuberculin Tests* *

Case 2	Oct. 25, 1923	Nov. 27, 1923	Jan. 26, 1924	March 8, 1924
Human tuberculin.....	Negative 0.2 mg.	Negative 0.4 mg.	Not done	Slightly positive 0.3 mg.
Bovine tuberculin.....	Not done	Not done	Positive 0.3 mg.	Positive 0.3 mg.

* The figures represent the quantity of tuberculin used.

Comment.—This patient developed axillary tuberculous adenitis coincident with whooping cough, which was possibly induced by injection of pertussis vaccine. The tuberculosis seemed to be of the bovine type. Eight months following the onset, group immunity began to appear.

CASE 3.—*History.*—A girl, colored, aged 11 months, was admitted to the hospital on Feb. 4, 1924. She had a brother, aged 2½ years, who was already in the hospital with pulmonary tuberculosis. She had had pertussis, the first symptoms beginning two months before admission.

The child was very restless and irritable, and had a temperature of 103 F. Fine crepitant râles were heard over both lungs. The liver and spleen were enlarged. The test with human tuberculin was negative but with bovine tuberculin was slightly positive. The child died on Feb. 11, 1924. The clinical diagnosis was generalized miliary tuberculosis, which was confirmed at necropsy.

Comment.—This patient had an overwhelming tuberculosis infection. One is not particularly surprised that there was a negative tuberculin reaction, and the slightly positive bovine tuberculin test is suggestive of the etiology. The diminished allergy from the overwhelming infection may explain the negative human tuberculin test.

CONCLUSIONS

Both bovine and human tuberculin should be employed in routine tuberculin tests, not only to determine the diagnosis of the type of tubercle bacilli present but also to increase the value of the test by detecting cases which would otherwise be missed. In our series, the missed cases would have amounted to 15 per cent. of the total tuberculous patients.

Evidence from two cases tend to confirm earlier reports that in the first stages of tuberculosis, the patient will react to but one type of tuberculin, presumably that of the infecting type, while later the patient reacts to other types (group reaction).

ACUTE PYOGENIC ARTHRITIS OF THE HIP JOINT IN INFANCY AND IN CHILDHOOD*

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There seems to be confusion in surgical literature in regard to the terminology of this disease. Acute epiphysitis, acute infectious synovitis and acute arthritis of the hip joint are often used synonymously, to indicate an acute inflammation of this articulation. Clinically and roentgenographically, in the early stages of the disease it is impossible to distinguish one from the other. Even in the more advanced stages, one cannot state with any degree of certainty where the disease began, whether in the capital epiphysis, in the synovial membrane, in the neck of the femur or in the acetabulum.

From a practical clinical standpoint, the terminology of this condition would be greatly simplified if considered as acute arthritis.

Acute pyogenic arthritis of the hip joint in the infant or child is a serious complication. It generally arises in the course of, or occurs as a sequela to, such acute infectious diseases as scarlet fever, pneumonia, typhoid fever or diphtheria, or to any local suppurative focus, such as gonorrhea, mastoiditis, pyelitis, boils, abcesses and the like. The blood stream, as a general rule, conveys the organism to the predisposed hip joint.

If the infection is virulent and the local resistance poor, complete destruction of the joint may occur in a short time. In such instances, extensive removal of bone is sometimes necessary to relieve symptoms and to save life. Spontaneous or pathologic dislocations and ankylosis in awkward positions occur frequently, which leaves the patient with deformities difficult or even impossible to correct.

Appropriate surgical and mechanical measures, applied promptly to the infected hip joint, prevent these disastrous end-results.

Protective muscle spasm is destructive in its effects on joints, being one of the principal causes of increased intra-articular tension. This is especially obvious in the hip, in which the surrounding musculature is the most powerful in the body. Destructive changes, such as deepening and widening of the acetabulum and absorption of the femoral head and neck, are caused by tremendous contact pressure of one articular surface against the other, induced by muscular contractions.

In very young children suffering from acute infections of the hip, pathologic dislocations occur spontaneously, because the ligaments are

* Received for publication, Oct. 27, 1925.

not fully developed; joint exudates and muscular action forcing the femoral head out of the shallow acetabular cavity.

SYMPTOMATOLOGY

The onset, as a general rule, is sudden, beginning with chills or convulsions, variable elevation of temperature, vomiting, nose blood and other symptoms. Preceding the metastatic involvement to a predisposed hip joint, the child may have arthralgic symptoms in a number of joints. When the infection finally lodges in one of the hip joints, it gives rise to the following train of symptoms: intense pain in the upper part of the thigh, buttock and groin; swelling of the thigh and buttock; inability to move the affected lower limb; flexion of the thigh on the abdomen; sensitiveness to passive motion, dilatation of the superficial veins and enlargement of the inguinal lymph nodes.

DIAGNOSIS

I wish to stress a few practical points in diagnosis, which I have found useful in differentiating between acute arthritis of the hip joint and other conditions which may simulate it. These points are based on a careful interpretation of the history, the physical examination, diagnostic puncture and roentgen-ray findings.

History.—The condition may begin as polyarthritis, with constitutional and local reactions characteristic of this disease. Several joints may be involved successively, clear up and then one predisposed joint, which may be the hip, bears the brunt of the infection. In that event, one must consider such a case as arthritis unless proved otherwise.

In the monarticular variety, the examination is depended on to reach a diagnosis.

Examination.—There are three signs to look for in acute hip disease: increase in synovial fluid, the characteristic position of the joint and the limitation of motion due to reflex muscle spasm. Even in the early stages, the examination reveals an increase in intra-articular fluid, manifested by a distension or ballooning of the capsule. This is elicited by careful palpation below Poupart's ligament, which will show the tense semi-elastic anterior portion of the capsular ligament. First, one feels for the femoral artery, which crosses the hip in this region. The position of flexion, abduction and external rotation that the thigh assumes is a very valuable sign, indicating increased joint fluid. In this position, the joint can accommodate the greatest amount of fluid with the minimum tension on the capsule. In a more advanced stage, the thigh is flexed, adducted and internally rotated. The joint is rigidly fixed in the position before named by a marked reflex muscle spasm

which limits motion in every direction. These three signs, when present, indicate an intra-articular disturbance, which usually is arthritis.

Diagnostic Puncture.—I wish to emphasize the value of the aspirating needle as an aid in diagnosis. I believe that diagnostic puncture is not performed as frequently as it should be. Under aseptic precautions, it is a procedure attended with little or no risk to the patient. No anesthetic is necessary. The groin and upper part of the thigh are prepared as for a surgical operation, and sterile gloves should be worn by the physician. An ordinary aspirating needle, 1.5 mm. in diameter and 9 cm. long, is inserted 1 cm. below Poupart's ligament and 1.5 cm. external to the femoral artery. The needle is directed straight backward until it strikes the neck of the femur. By flexing the thigh, the anterior portion of the capsule is relaxed, which permits easier penetration. There is no danger to this procedure, as there are no important structures that can be injured. The results of aspiration will generally establish the diagnosis. When excessive fluid is present, it usually indicates synovial irritation. One may frequently encounter a dry tap, but the investigator should not be content with one puncture. Perhaps another one, made a day later, will be more successful in locating the exudate. The fluid may be serous in character, sterile on culture. If so, it generally indicates a mild inflammatory reaction. If it is purulent and organisms are discovered, the future integrity of the joint is at stake.

Many pyogenic organisms seem to display peculiar predilections for certain tissues. For instance, the gonococcus has this predilection for the subsynovial layers of the capsular ligaments. It produces first, a periarthritis, later an inflammation of the secretory synovial membrane, the manifestations of which are intra-articular exudates which may be serous, serofibrinous or purulent. This organism rarely invades bone in the early stages.

Many of the mild strains of streptococci produce reactions in the joints, similar to those produced by gonococcic invasions.

Staphylococcic infections are invariably virulent and invasive. Cartilage and bone are rapidly involved. On culture if these organisms are recovered, surgical treatment—incision and drainage of the joint cavity, traction and fixation—should be instituted forthwith. The cases mentioned here will illustrate these facts. It must be remembered that any case of acute pyogenic arthritis may, as time goes on, develop into panarthritis, because the organisms may be virulent, the local resistance poor, or the treatment inadequate or misapplied.

I believe that the result of aspiration is of definite diagnostic value in showing the degree of the inflammation and the type of organism that has produced it.

By keeping in mind the points before mentioned, one can strike a differential diagnosis between acute arthritis of the hip and acute osteo-

myelitis of the upper end of the shaft, a condition with which it is most frequently confused.

Roentgen-Ray Examination.—The roentgen ray is usually negative in the incipient stages of acute arthritis of the hip. What is usually observed on the film is swelling of the soft tissues, and in very young children, widening of a joint space or a pathologic dislocation. Later, as the infection progresses, or the intra-articular tension remains unrelieved, erosion of the acetabulum or femoral head and flattening of the head may be depicted on the roentgen-ray film. One must not infer from the negative roentgen-ray findings that there are no pathologic disturbances in the joint, if the clinical manifestations point in that direction.

The longer the duration and the more virulent the infection, the sooner will the roentgenogram give positive evidence of bone absorption. Operative trauma will also show roentgen-ray evidence of destruction. The latter must be taken into account when reading roentgenograms subsequent to operation. Tremendous bone proliferation frequently follows curettage. One of the patients mentioned here showed a tremendous enlargement of the trochanter, a bridge of bone springing from the trochanter and extending almost to the ilium. This followed a curettment. The surgeon must have implanted periosteum into the soft tissues, and this gradually became ossified. In this case, the condition was not due to the infection but to operative trauma.

DIFFERENTIAL DIAGNOSIS

There are a few conditions of the hip joint in children which may simulate acute pyogenic arthritis. These are tuberculosis of the hip joint, acute inguinal adenitis, acute psoitis, toxic arthritis of the hip and acute osteomyelitis of the upper end of the shaft of the femur.

Tuberculosis of the hip joint is excluded by the history, clinical course, roentgenogram and laboratory studies. The symptoms are mild, intermittent and insidious in development. The onset is never sudden or explosive, as it is in acute arthritis.

Acute inguinal adenitis is characterized by acute pain in the groin, flexion of the thigh and elevation of temperature. Careful examination of the hip joint will reveal that the hip has a free range of motion except extension. The lymph nodes in Scarpa's triangle are enlarged and sensitive to pressure. Usually there is an accompanying lymphangitis. The constitutional and local reactions are not severe. Under treatment, this condition subsides in a short time.

Acute psoitis, or acute inflammation of the psoas muscle, is characterized by persistent flexion of the thigh on the abdomen. It indicates perirenal suppuration of psoas abscess. Motion of the hip joint is free in all directions except extension.

Toxic arthritis is mild in its clinical course and of short duration. This condition is due to absorption of toxins from the gastro-intestinal tract, a thorough cleansing of which will produce a prompt subsidence of the symptoms.

Acute Osteomyelitis of the Femur.—The diagnosis is most difficult when it somes to differentiating between acute arthritis of the hip joint and acute osteomyelitis of the upper end of the femur. Even after using all known means, it is often necessary to resort to an exploratory operation on the hip to make the diagnosis clear. The reason for this is the deep situation of the hip joint and the fact of its being surrounded by bulky muscles, large blood vessels, lymphatic and nerve trunks. About two thirds of the neck of the femur is within the cavity of the joint. Edema of the soft tissues is present in both of these diseases, obscuring any underlying pathologic changes. In these doubtful cases, an arthrotomy of the hip should be performed and the joint explored. If, after incising the capsule, fluid under tension is evacuated, arthritis is evident. The character of the fluid determines the type of the infection. In the event of negative findings, the arthrotomy wound is closed, and another incision is made at the point at which the osteomyelitic process is suspected and the shaft of the femur drilled. Such a course, somewhat modified, was pursued in one of the patients mentioned below. The results obtained proved the wisdom of this procedure. The child made a complete recovery from a severe staphylococcus albus infection of the hip, with acute osteomyelitis of the femur.

In a concrete form, I am giving the salient features of fourteen cases of acute pyogenic arthritis of the hip joint, that were under my observation in the Mt. Sinai and the Polyclinic Hospitals.

These cases are divided into two groups. The first consists of a series of eight cases of acute gonococcus arthritis of the hip in the new-born. The second group comprises six cases of acute pyogenic arthritis of the hip joint in older children, caused by organisms other than the gonococcus.

GROUP ONE, GONOCOCCUS ARTHRITIS

Those patients with hip trouble were selected from a number of those with gonococcus arthritis in the new-born, who had been treated in the Mt. Sinai and in the Jewish Maternity Hospitals. In a forthcoming communication, this remarkable outbreak of gonorrheal arthritis in the new-born will be reported.

The portal of entry of the infection was the rectum. The gonococci were carried to the joints by the blood stream. In fifty-three cases of gonorrheal polyarthritis, eight had hip joint involvement. No double hip infections were observed, five were on the right side and three were on the left. Four of the patients were males and four were females.

The symptoms were pyemic in nature. On the seventh to ninth day after birth, a macular rash appeared on the body, and there was a slight elevation of temperature, ranging between 100 to 101.3 F. Two weeks after birth, these infants presented boggy, painful joints, vaginal and rectal discharges, and ischiorectal and multiple abscesses in different parts of the body. Gonococci were found on smear from the rectum, vagina, abscesses and purulent joint exudates. When I first examined these infants, the disease had existed from three to four weeks.

Hip Infections.—In every hip infection, a pathologic dislocation was already in evidence when I first examined the infants. This was demonstrated by the roentgen ray and by physical examinations. The

Fig. 1.—Gonococcus arthritis of the right hip in an infant, aged 5 months. This shows the upward dislocation of the right hip joint.

thigh was rigidly flexed on the abdomen. The upper part of the thigh and buttock of the affected side was tumefied and swollen, and passive motion was limited in all directions. The trochanter was elevated above Nélaton's line. There was a marked spasm of the iliopsoas muscle. It was practically impossible to extend the limb. Curvature of the spine was observed in each case, the spine curving laterally to the side opposite the diseased hip. These spinal distortions were due to the tonic spasm of the iliopsoas and lumbar muscles. Two of these infants showed a rigid kyphosis at the lumbosacral junction. This was due to bilateral psoas contractures. These spinal distortions completely disappeared in from two to three months. In three infants, there was a pseudoparalysis of

the leg below the knee, with a marked atrophy of the calf. These nerve symptoms were undoubtedly due to infiltration and edema of the lumbosacral plexus. Intra-articular suppuration could not be detected. Frequent punctures were made for diagnostic purposes but with negative

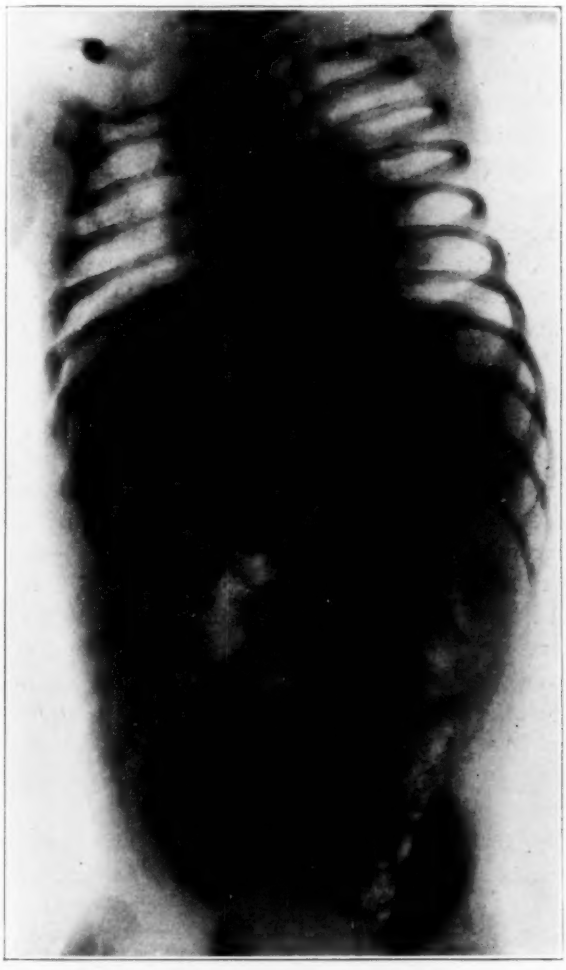

Fig. 2.—Curvature of the spine to the left and upward dislocation of the right hip (gonococcus arthritis of the right hip).

results. This was due to the fact that the soft tissues were so tumefied and thickened, and the joint so deep, that it was practically impossible to locate the intra-articular exudate with the aspirating needle. It is interesting to note that while intra-articular effusions could readily be demonstrated in the knee joint, they could not be detected in the hip.

A singular feature of the outbreak was the remarkable resistance to the infection which was displayed by these infants. Most of them throve in spite of the disease, and there was not a single death.

TREATMENT

In view of the complicated nature of these cases, considerable difficulty was experienced in their management. The indications were to relieve the pain and sensitiveness of the inflamed joints, to reduce the periarticular infiltrations and to correct the deformities. At first, small, double, Jones' abduction hip splints were employed, but these soon proved unsatisfactory, being thrown out of adjustment when the infants were handled. Plaster casts were then employed, which while very difficult to apply to these small children, answered very well in immobilizing the infected joints and made nursing a comparatively easy task. These plasters reached from the middle of the thorax and included both lower limbs to the toes. They were applied to the infant over stockinette and felt, the limbs held by the assistant in as much extension and abduction as was possible to obtain during the application. After trimming the casts widely, to expose the genitalia and buttocks, they were covered with cello silk to prevent the discharges from soiling them. Large vulvar gauze pads were used, instead of diapers, to collect the purulent discharges, urine and stools. In spite of these precautions, the plasters had to be changed frequently, because the skin became irritated. At each change of plaster, the limbs were extended and abducted into better positions. After from six to seven weeks of immobilization, we obtained the desired results, namely, relief of pain and sensitiveness and correction of the spinal deformity, the spine having become straight and flexible; the thighs were in almost complete extension with the trunk and the range of hip motion was increased. The tumefaction and swelling of the soft tissues persisted. The dislocations remained unreduced. On discontinuing the casts, diathermia was instituted. We found this agent of great value in reducing the edema and tumefaction. It was administered in the dosage of 200 milliamperes for twenty minutes daily, the electrodes being applied to the buttock and thigh of the affected side. After each treatment, the indurated parts were gently massaged and the joints manipulated.

In the course of four months, a marked improvement was noted in the local and general condition of these infants. The infiltrated parts became softer, the edema was relieved and the range of motion was increased. Diathermia was discontinued when these infants were 6 months of age. They are still under observation, returning every two or three weeks to the orthopedic clinic of the Mt. Sinai Hospital. These infants are now 14 months of age, and they appear well nourished. The dislocations persist. There is a shortening of the affected side, ranging

from ¼ to ½ inch. The children move their limbs as actively as if nothing had ever happened. There is no residual muscular atrophy or paralysis. We do not contemplate reducing the dislocations at the present time, for fear of stirring up a latent infection or of fracturing the femur. When they are 18 months of age, an attempt will be made at reduction.

Incidentally, I might state that the primary foci of infection, the vagina and the rectum, have completely cleared up. During the acute stage of the disease vaccines were used in some of the infants, but, from my observation, without any apparent benefit.

Fig. 3.—Type of cast used in gonococcus infections of the hip joint in the new-born. Note wide exposure of the genitals, so that local treatment could be instituted for vaginitis. Also note the well nourished condition of the infant.

GROUP TWO, ACUTE PYOGENIC ARTHRITIS

This group comprises six cases of acute metastatic arthritis of the hip joint in four males and two females, ranging in age from 5 to 13 years. The infection was monarticular in all these cases, the right hip being involved in four and the left hip in two children.

The exciting causes of the arthritis were the following: *Streptococcus hemolyticus* in three cases, *Staphylococcus aureus* in two cases and *Staphylococcus albus* in one case. The portal of entry for the infection was demonstrable in the streptococcus group. In two instances acute suppurative mastoiditis was the primary cause. The hip involvement

occurred two and seven days respectively after mastoidectomy. In the other case the infection began sixteen days after an attack of acute pyelitis, which was the primary cause.

The portal of entry in the staphylococcic group could not be demonstrated. In one case the hip involvement occurred nine days after the onset of illness, in another case three days and in the other one, the disease was initiated with acute pain in the affected hip.

The symptoms and clinical course of these cases were characterized by severe constitutional and local reactions. The temperature range was high and septic in type, the prostration was extreme and the suffering was intense. The pain in the hip was agonizing, deep seated and worse at night. These children could not bear the slightest movement of the limb, and the shaking of the bed gave rise to intense pain. They were in constant fear, during an interval of freedom, lest the pain would return. In all of these patients the thigh was flexed on the abdomen. An intense muscle spasm was present, limiting motion in all directions. The joint was so sensitive, that merely touching the limb caused these children to cry out in pain. The upper part of the thigh and buttock of the affected side were swollen, the superficial veins were prominent and the skin was glossy. The glands in the groin and Scarpa's triangle were enlarged and sensitive. Points of tenderness were elicited over the trochanter, tuberosity of the ischium, pubic rami and symphysis. Fluctuation was observed in one case, a child who had had the infection for three weeks.

The blood picture showed a uniformly high leukocyte and polymorphonuclear count. The blood cultures were positive in all cases. Within the first two weeks of the infection, the roentgenograms were negative in every case. Positive reports were returned later in two patients who were not operated on. In these, the roentgenogram showed increased depth of the acetabular cavity and flattening of the femoral head. I believe these changes were caused by the intense muscle spasm, rather than by the infection. In two cases, the roentgen-ray findings, before operation, were negative; shortly after operation (incision, drainage and curettage) the roentgenogram showed considerable bone destruction. Two children treated conservatively, from the very start of the infection, showed no evidence of disease by roentgen ray.

Diagnostic puncture was performed during the acute stage of the disease in three patients. The result were two dry taps. In one, a serofibrinous fluid was withdrawn. In two, the condition was diagnosed as acute osteomyelitis of the upper end of the femur by the surgeons in attendance during the acute stage of the disease. The diagnosis was evidently based on the clinical manifestations, as the roentgen-ray find-

ings were negative. These children were operated on, the soft tissues were incised and drained, but apparently the hip joint was not explored; neither traction nor immobilization were employed. A panarthritis developed in both instances, necessitating a resection of the hip in one of the children. In the other, a bony ankylosis resulted.

Treatment.—S. R. was treated by intravenous injections of mercurochrome-220 soluble and antistreptococcic serum during the first week of illness but the symptoms were not allayed. Weight extension was then applied, but this also was ineffective. Not until a plaster cast was applied did she obtain relief from the agonizing pain.

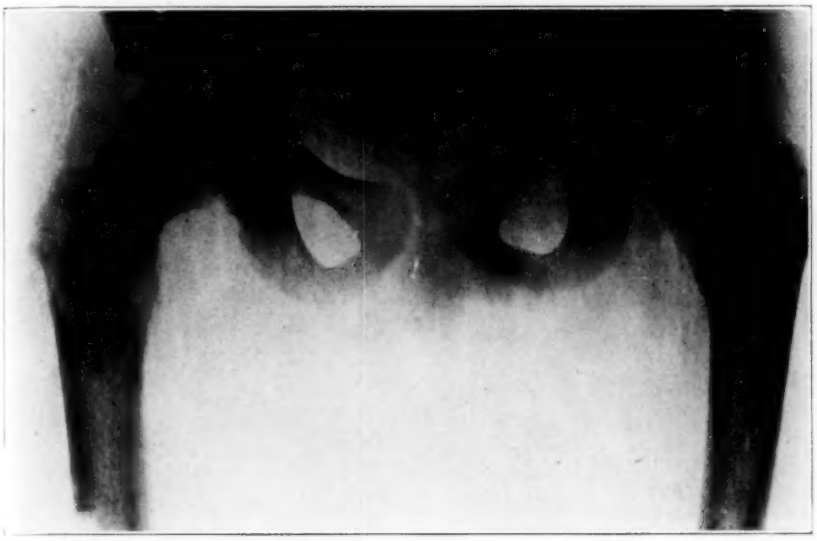

Fig. 4.—Staphylococcus arthritis of the right hip; osteomyelitis of the right femur. Note the periosteal thickening of the femoral shaft.

S. G. was treated by weight extension and sand bag fixation, as soon as the disease was recognized. The pain in the hip was relieved, the disease was of short duration. The child recovered in three weeks without any other surgical measures.

J. B. suffered from an unrecognized hip abscess for three weeks. After incision and drainage of the abscess and weight extension, the pain and suffering were relieved and the temperature promptly subsided. The child recovered normal hip function.

J. C. was ill for ten days, suffering from a virulent staphylococcic arthritis of the hip. The toxemia was marked and the pain agonizing. Prompt and efficient treatment was instituted which undoubtedly saved his life. One hour after admission, the hip was incised and drained, the femur was trephined, weight extension was applied immediately after operation and a plaster cast several weeks later. Subsequently, he wore a hip brace for several months. The hip joint at the end of six months showed complete restoration.

Contrast the foregoing four cases with the two that follow, in which neither extension nor fixation were employed in the early stage of the infection, and the results were disastrous.

In the case of G. G., a plaster cast was applied to the hip five weeks after onset. Prior to this, several operations had been performed without relief of symptoms. In this case, there was an extensive osteomyelitis of the head, neck and trochanter, and several sinuses were present, draining pus. After the cast was applied, the pain was immediately relieved. This child recovered after one year of suffering; the hip joint was ankylosed.

The worst case in this series was E. W., on whom three operations were performed and finally a resection of the upper end of the femur, to relieve the suffering. Neither weight extension nor fixation were employed at any time during the course of the acute stage. All the operations that were performed on her were of no avail in preventing progressive destruction.

Fig. 5.—Panarthritis of the left hip. Note the head of the femur, which is decalcified and lies free. Osteomyelitis of the pubic rami. The roentgenogram was taken two months after onset of disease.

COMMENT

The conclusion that can be derived from the foregoing is, that perfect rest is of the first moment, and unless this is secured, no other treatment can be of any benefit. There is nothing that will relieve the pain so promptly and prevent extension of the disease, better than weight extension and immobilization. The excessive and agonizing pain results partly from contact pressure of one inflamed articular surface against the other, induced by the tonic contractions of the muscles surrounding the hip. Weight extension and immobilization prevents destructive disorganization and consequent ankylosis.

Even when a definite osteomyelitis of the head, neck or acetabulum is present, with the joint filled with pus, the disease can be arrested and joint function preserved by incision and drainage combined with the before-mentioned mechanical measures. In these cases, after recovering

from the infection and during the subacute or chronic stage when the child is ready to bear weight, the hip joint should be protected by a traction hip brace, the child wearing a high shoe on the well side and using a pair of crutches. This especially pertains to those patients in whom surfaces have become eroded. These children should be kept under observation for several years.

SUMMARY

1. Acute gonococcus infections of the hip joint in the new-born are characterized clinically by early, spontaneous dislocations. Immobilization in plaster casts and diathermia are of definite curative value in preventing destruction and relieving the inflammatory reactions. Reduction of the dislocation should not be attempted during the acute stage. Vaccines have proved valueless.

2. Streptococcus and staphylococcus infections of the hip joint in older children are characterized by severe constitutional and local reactions. Destruction of the joint is induced by unallayed muscle spasm and extension of the disease through contacting pressures. Incision and drainage, extension and fixation relieve symptoms and prevent progressive destruction of the joint. Intravenous therapy has proved of little value.

3. Children who have recovered from the acute infections should be under observation for at least one year. Deformities frequently have to be corrected or pathologic dislocations reduced.

2017 Pine Street.

COARCTATION OF THE AORTA

REPORT OF CASE *

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Coarctation of the aorta is one of the least common congenital cardiac anomalies. Two distinct types have been described, which probably differ in etiology as well as in clinical manifestations.

1. A diffuse narrowing of the aorta at the isthmus, that is, that part of the vessel which lies between the left subclavian artery and the insertion of the ductus arteriosus. This condition is probably congenital, and is due to arrested development resulting in failure of the vessel to attain normal size. Of 198 cases of coarctation of the aorta collected by Abbott [1] in 1908, sixty-eight were of this congenital type, and of these sixty-one died within the first year of life. These cases were very frequently associated with grave congenital defects, such as patent septums, transposition of the great vessels or pulmonic stenosis. In 66 per cent, the ductus arteriosus remained patent. The case reported here is of this type.

2. A more or less abrupt constriction of the aorta at or near the insertion of the ductus arteriosus. This is probably an acquired condition and is caused by the pull of the ductus on the aorta. In Abbott's series of 198 cases, 130 were of this acquired type and of these only eight died in the first year of life. About half of these patients died between the ages of 20 and 40, and thirteen lived to be 60 years of age. These cases were not often associated with other grave congenital anomalies, and the ductus arteriosus was patent in only 10 per cent. Collateral circulation was well established, involving, among other arteries, the internal mammaries, the superior intercostals, and the superficial and deep epigastrics. Tortuous pulsating vessels of unusual size were characteristic clinical findings.

Hypertrophy and dilatation of the heart was rare in the congenital cases (infantile), and common in the acquired (adult). For further

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* Received for publication, Oct. 19, 1925.

* From the Departments of Pediatrics and Pathology, University of Louisville Medical School.

1. Abbott, Maud: Coarctation of the Aorta, Osler's Modern Medicine **4**: 405-415, 1908.

description of this condition the reader is referred to textbooks on the subject.

The following case of coarctation of the aorta of the congenital or infantile type is reported.

CASE REPORT

History.—M., a boy, white, was born Dec. 21, 1924. His birth weight was 4,500 gm. He was the first baby, of healthy parents. The delivery was comparatively easy. The mother was in labor for eighteen hours, and 0.5 c.c. of pituitary extract was used twice during the third stage of labor because of inertia uteri. No forceps were used. Resuscitation of the infant was very difficult. It was only after forty minutes work that the baby breathed without assistance. Various methods of resuscitation were used, including blowing into the mouth, flexing the thighs over the abdomen, and compression of the lower ribs (Schaefer). Cyanosis was not present unless the baby ceased to breathe. Respirations were never regular and at times were Cheyne-Stokes in appearance. The baby moaned for twelve hours after delivery. Eighteen hours after birth, convulsions began and continued at intervals of from thirty minutes to two hours until death. These convulsions were not generalized, but were limited to the face and upper extremities.

Physical examination showed nothing of importance. The anterior fontanel was 2 by 2 cm., flat, and seemed a little more tense than normal. There was almost no edema of the scalp. The heart was not enlarged to percussion, the sounds were regular, and there were no murmurs. The knee and ankle jerks were active and equal. Muscular development was symmetrical and good. The color was rosy except during convulsions.

Cistern puncture was made when the infant was 24 hours old. The spinal fluid was clear, under no pressure, and showed 4 lymphocytes per cubic millimeter. No red blood cells were present. Six cubic centimeters of fluid was removed; no improvement followed this procedure. At 36 hours of age, cistern puncture was repeated and 8 c.c. of clear spinal fluid under no increase of pressure was removed. The cell count was 5 lymphocytes per cubic millimeter. No red blood cells were present. There was no increase in globulin content. Coagulation time, taken at the age of 36 hours, lasted for four minutes. The infant died at the age of 40 hours.

Necropsy.—This was performed seventeen hours after death, at which time the infant weighed 4,000 gm.

The body was that of a well developed, well nourished, white boy, showing no gross abnormalities or deformities. There was a fair amount of light red hair on the head. The body was covered with a fine, downy growth. The umbilical cord was tied, the stump of 4 cm. was dry and clean. There was marked lividity in the dependent portions, arms and face. The pupils were 3 mm. in diameter and equal. The lips were dry, dark purplish, and slightly fissured. At the hair margin in the midline at the back of the neck were two closed puncture areas 1 mm. in diameter, which were clean.

The anterior fontanel was open. Subcutaneous tissue of the scalp showed some congestion. No bruise or blood clot was found. There was considerable enlargement of the meningeal vessels, with some distention.

Brain.—On removing the brain, no free blood clot was found. There was no extradural blood clot. The internal architecture of the scalp was normal.

Peritoneal Cavity.—The peritoneum was clean; the liver margin was in the right midclavicular line, 4 cm. below the costal border and 4 cm. below the tip of the xiphoid.

Pleural Cavities.—The left cavity was clean. The thymus extended down over the pericardial cavity to the atriaventricular junction. The right pleural cavity was also clean.

Pericardial Cavity.—The pericardium was clean. The cavity contained about 30 c.c. of serous fluid. The heart was distended; it lay in a horizontal position in the chest, with a slight angle of the apex downward; the blood vessels were tremendously engorged. The apex of the heart was 4 cm. to the left of the midsternal line at the sixth rib. The right margin of the heart was 2.5 cm. to the right of the midsternal line.

Heart.—This was opened in situ. The right auricle was filled with a blood clot. The interior of the right auricle showed normal architecture and had a patent foramen ovale, measuring 7 mm. in diameter. The right ventricle

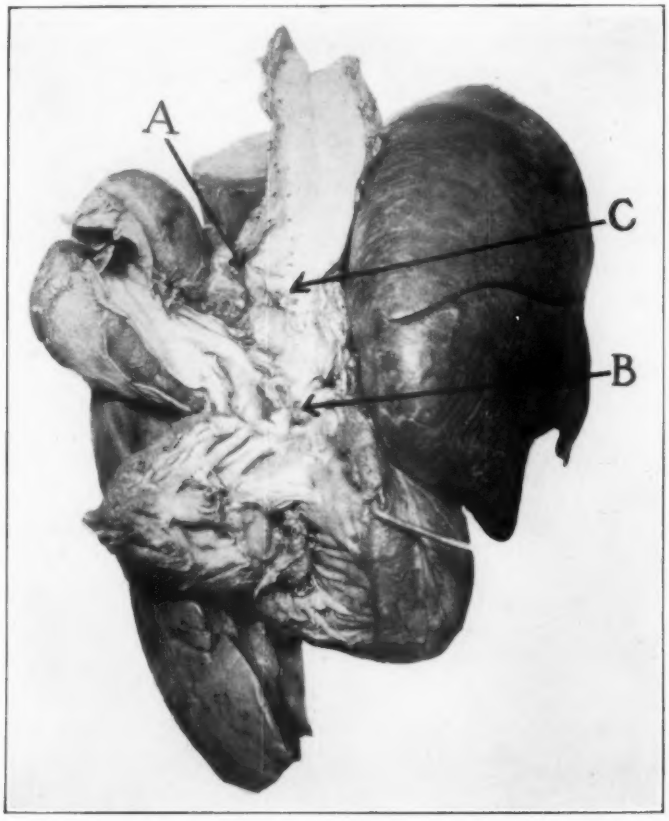

Fig. 1.—The heart with lungs and aorta attached. *A*, point of coarctation; *B*, pulmonary valve; *C*, opening of patent ductus arteriosus into aorta. Note relative circumference of aorta and patent ductus arteriosus.

was normal in appearance. The pulmonary artery was relatively large as compared with the aorta. Its wall was about the same thickness as the wall of the aorta. It branched at the hilum of the right and left lung, each branch measuring 4 mm. in diameter. This artery was continuous as the ductus arteriosus, measuring 7 mm. in diameter at its beginning at the ductus and 10 mm. in diameter at its junction with the descending limb of the arch. The left auricle and ventricle had their normal relations and openings. The lumen of the ascending and transverse arches of the aorta measured 7 mm. in diameter. After the great vessels to the head were given off, it diminished, reaching a

minimum of 4 mm. It then widened, until at the junction of the descending arch with the ductus arteriosus, it again measured 7 mm. The arch of the aorta gave off the branches common to it in their normal relations.

Measurements of Heart.—Transverse diameter, 39 mm.; vertical, 42 mm.; tricuspid valve, 40 mm.; pulmonary valve, 22 mm.; mitral valve, 39 mm.; aortic valve, 20 mm.; left ventricular wall, 6 mm.; right ventricular wall, 6 mm.

Lungs.—These were voluminous with diminished crepitation at the bases, and were dull pink and flabby. The cut surface was moist and clean.

Kidneys.—The left kidney weighed 20 gm.; the right, 25 gm. On exposing the left kidney it was found to be surrounded by a mass of blood clot. The connective tissue surrounding the suprarenal gland contained the greatest amount of the clotted blood. The ruptured blood vessel was not determined. The organ had normal fetal lobulations. The differentiation was distinct and there was no hemorrhage internally. The right kidney was free from clotted blood. The right perirenal structures were free from extravasated blood.

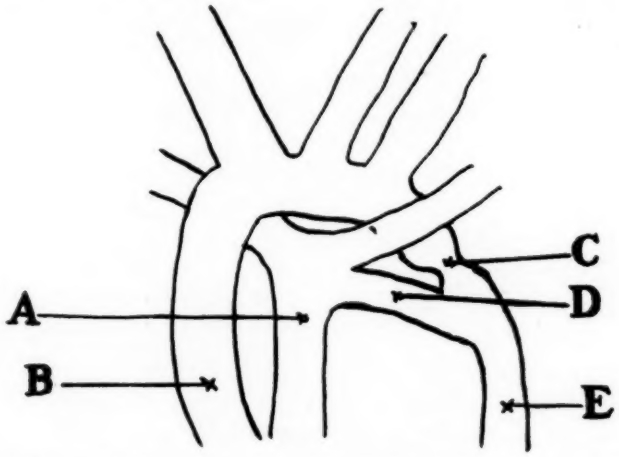

Fig. 2.—Schematic drawing. *A*, pulmonary artery; *B*, ascending aorta; *C*, coarctation; *D*, ductus arteriosis; *E*, descending aorta.

The gastro-intestinal tract showed no changes nor abnormalities. The spleen was of normal size and shape. The liver was normal in size and showed no changes.

The anatomic diagnosis was: coarctation of aorta; patent ductus arteriosus; patent foramen ovale; extravasated blood in left perirenal structure; puncture wounds at the back of neck.

COMMENT

The interesting point about this case is the similarity of its clinical manifestations to those of intracranial injury caused by birth trauma. Intermittent periods of cyanosis, irregular respirations and convulsions are signs of increased intracranial pressure. It is logical to believe that marked narrowing of the lumen of the aorta distal to the great vessels supplying the head would cause increase of intracranial pressure. The diameter of the ascending arch of the aorta was 7 mm., and it had diminished to 4 mm. just distal to the point of origin of the left sub-

clavian artery, later widening to its original diameter before joining with the ductus arteriosus.

It is also interesting to note that in cases of so-called acquired coarctation of the aorta, mild symptoms of increased intracranial pressure are found, such as a feeling of plethora, vertigo, headache and epistaxis.

The hemorrhage into the perirenel tissue was not considered sufficient to have entered into the clinical picture. It was probably caused by the vigorous efforts at resuscitation.

THE CHYLOMICRON (FREE FAT) CONTENT OF THE BLOOD IN INFANTS*

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INTRODUCTION

Lipemia, or milkiness of the blood serum, has been recognized for centuries. This appearance is due to the presence of innumerable minute fatty particles which are poured into the blood from the chyle. These particles were called by Gulliver, "the molecular base of the chyle," and have had various names, such as fat dust, blood dust, hemokonia and chylomicrons. We use Gage's [1] term, chylomicrons, because it has the advantage of indicating the origin and the approximate size of the particles.

In spite of the importance of questions relating to the metabolism of fat, few studies are available. Until recently, such studies were hampered by the need for large quantities of blood for making chemical analyses, and by the difficulty of estimating the degree of lipemia as judged by the number of chylomicrons. Bloor,[2] by means of chemical analyses, has studied the various lipoids in plasma, corpuscles and whole blood under normal conditions as well as in cases of abnormal lipemia. Roughly estimated, the normal blood contains from 0.6 to 0.7 per cent. of fat. During digestion, the fat increases in the plasma and in the cells, but in abnormal lipemia, such as occurs in diabetes, the fat content of the cells remains constant and is independent of the plasma increase. Gage,[3] by means of the dark-field microscope, has studied the changes in the visible lipemia hourly. His method is simple, takes but a few minutes to reach the determination and requires only one drop of blood. Using this method, Gage and Fish,[4] have studied the lipemia which

* Received for publication, Sept. 25, 1925.

* From the Department of Pediatrics, Cornell University Medical College.

1. Gage, S. H.: The Cornell Veterinarian **10**:154-155, 1920.

2. Bloor, W. R.: Consult the indexes of the Jour. of Biol. Chem. from 1912-1922 for many important contributions to the physiology of fat; Physiol. Rev. **2**:92-155, 1922.

3. Gage, S. H.: Anatomical Record, Proceedings of the American Association of Anatomists, 1920, pp. 233-234; 1921, pp. 63-64; 1923, p. 130.

4. Gage, S. H., and Fish, P. A.: Presence of Micro-Particles in the Blood and Other Body Fluids, Jour. Amer. Vetr.-Med. Ass'n. **53**:384-402, 1921; The Ultra Particles of the Blood and Chyle, The Cornell Veterinarian, April, 1921, pp. 230-234; Fat Digestion, Absorption and Assimilation in Man and Animals as Determined by the Dark-Field Microscope and a Fat Soluble Dye, Am. J. Anat. **34**:1 (Sept. 15) 1924.

normally follows a fatty meal. In their studies of fat digestion and absorption in man and in animals, they not only obtained curves for a single meal, but also studied the effects on digestion of different fats by exercise, worry and prolonged fasting. Their studies have opened new vistas in the investigation of fat digestion, absorption and assimilation. This work is of interest to pediatricians because, as Gage and Fish state, "The importance of the fatty foods and the rôle played by fat in the human and animal organism can hardly be overestimated; besides, the production of energy arising from the oxidation of fat into carbon dioxid and water, the water so produced being greater in amount than the fat itself, has for some (and perhaps for all) animals a profound significance."

In this paper, chylomicron curves are presented from infants varying in age from 2 weeks to 11 months. The children were of the usual type seen in a ward for infant feeding, but except when noted, none were suffering from any acute illness.

The relation between the chylomicron count and the total blood fat is beyond the scope of this paper, as no attempt was made to study the distribution of blood fat by chemical methods, the study being concerned solely with the visible lipemia which occurs normally during the digestion of fat.

METHOD

For the study of the chylomicrons, a microscope equipped with a dark-field condenser, an oil immersion objective of 0.80 to 0.85 numerical aperture, and an ocular in which there is a micrometer net of 15 half millimeter squares, are needed. The best dark-field is obtained when the slides used correspond in thickness with the focus of the condenser. The one used by us required slides of about 1.5 mm. thickness. The cover slips used should not exceed 0.18 mm. in thickness. The glassware must be absolutely clean. Heavy oil for sealing and homogenous oil for examining the preparations are required. A powerful source of light is necessary.

The method of preparing the film for examination is familiar to everyone who has examined a fresh drop of blood under the microscope. The drop of blood is obtained by pricking the skin of some part of the body, and, except as a matter of convenience, it makes no difference what part. The needle is sterilized and the skin wiped thoroughly with alcohol. The first drop of blood is wiped off with a clean piece of gauze, and the next drop is caught on a cover slip. The cover slip is inverted on a slide and gently pressed down with forceps so that the blood spreads out in an even film. Any excess is wiped away with gauze, and the preparation is sealed with heavy oil to prevent drying. Properly sealed, the preparation will remain in good condition for at least twenty-four hours.

To examine the preparation, a drop of immersion oil is placed between the condenser and the slide, and another drop between the cover slip and the objective and focused until a sharp image is obtained. After this the focus is not changed for that particular field. For any drop of blood the chylomicron count is the number of chylomicrons within the area of the net micrometer. This is decided as a matter of convenience and is arbitrary. Gage has calculated that a count of 100 per field represents 79,317,866 chylomicrons per cubic millimeter of blood. To count the chylomicrons the specimen is moved until a space the size of the micrometer is found free from blood cells. By devoting the entire attention to one square at a time, and by counting very quickly, it is possible to estimate the number of dancing particles in a field. When all the fifteen squares have been counted, the slide is moved and the process is repeated until five fields, or seventy-five little squares, have been counted. The average of these five counts is taken as the chylomicron count for that drop of blood. In considering the estimation of chylomicrons by means of the dark-field microscope, three questions arise. Do the chylomicrons represent minute particles of blood fat? With what degree of accuracy can the chylomicrons be counted? What relation does the lipemia bear to the total blood fat as shown by the chylomicron count? Gage and Fish have answered the first question: "The emulsion in the chyle and blood is known to be fat because: (*a*) The particles rise and form a cream on top as with milk. (*b*) If in sufficient amount, the emulsion when dried on paper gives a grease spot. (*c*) The emulsion when dried and extracted with ether or other fat solvent and the solvent evaporated gives a solid fatty substance. (*d*) This fatty substance stains black with osmic acid, and red with sudan III and scarlet red. (*e*) It has the iodin absorption of fat. (*f*) It has the refractive index and the dispersion of fat. Gage has also shown that the chylomicrons do not appear in the blood after the ingestion of protein or carbohydrate. There seems, therefore, to be little question as to the nature of the chylomicrons.[5]

An estimation of the number of chylomicrons was formerly considered impossible, but Gage states that the accuracy of this method is "within the limits of experimental error unavoidable in many physical measurements." The following checks show a surprising uniformity of figures, making several preparations at the same time and counting five fields in each, saving a slide and recounting later, and having several observers examine the same slide. The question of counting particles other than chylomicrons arises; dirt on a slide appears as fine bright particles, but shows no brownian movement, and if only dancing particles are counted there should be no confusion. Variations in

5. See Figures 1, 2 and 3, all after Gage and Fish.

the thickness of the film may be disregarded, for Gage has shown that for particles the size of a chylomicron the microscope has a visual depth of 1.25 microns. The amount of fat in emulsion depends on the size as well as on the number of particles. As nearly as can be determined, the chylomicrons vary from 0.5 to 1.0 microns in diameter, and may be slightly larger at the height of absorption.

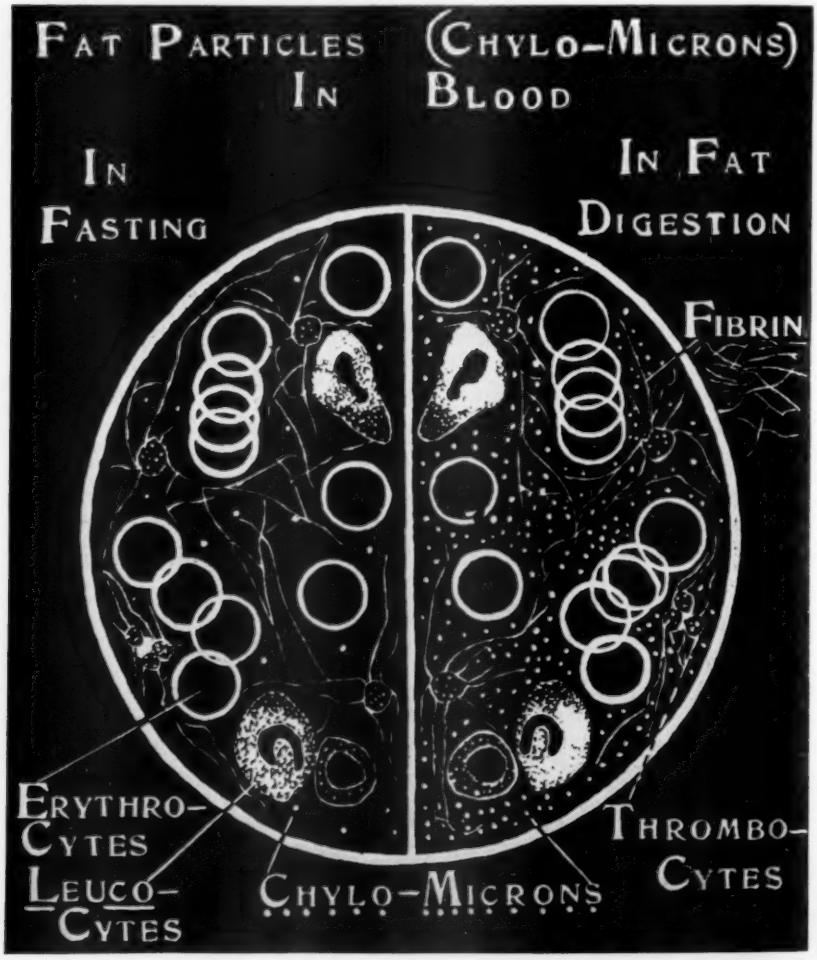

Fig. 1.—Fresh blood under the high-power magnification dark-field microscope. The left half after from sixteen to twenty-four hours' fast. The right half from three to four hours after a meal with plenty of fat. Chylomicrons, or fat particles, are numerous in the right half, and few in the left half. Erythrocytes, or red blood corpuscles. Fibrin, the fine, cobweb-like filaments present in coagulated blood. Leukocytes, or white blood corpuscles. Thrombocytes, or blood plates.

Probably 60 per cent. of ingested fat appears in the form of chylomicrons. As none of the other forms in which fat might appear in the blood is capable of demonstration by the dark-field microscope, it therefore follows that the chylomicron curve cannot be affected by them. Curves resulting from chemical determinations of blood fat would

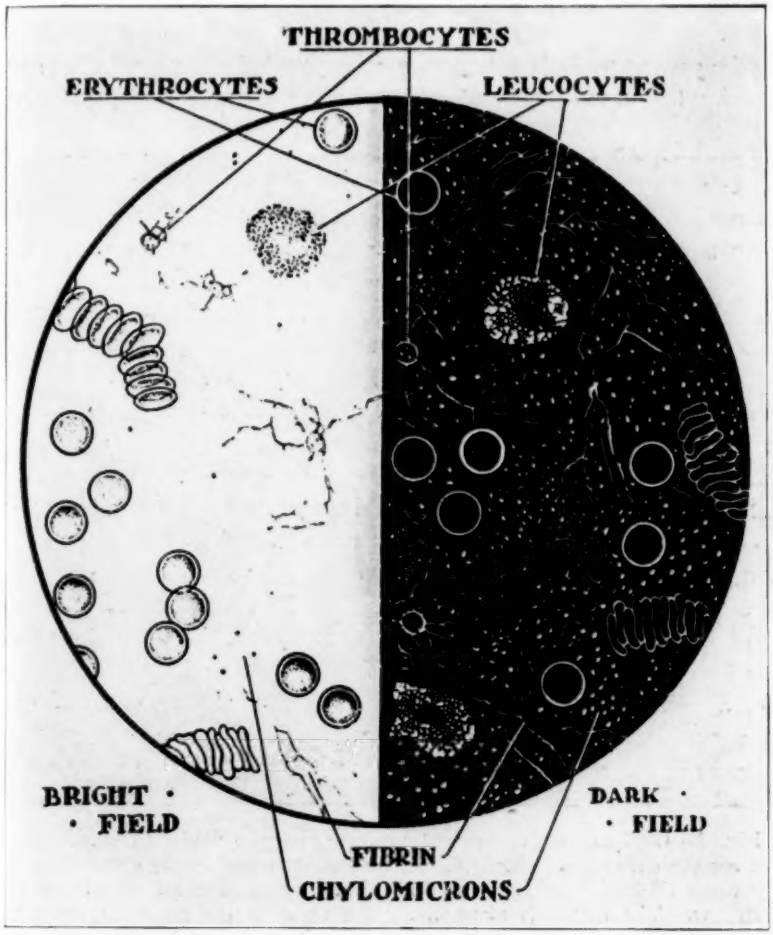

Fig. 2.—Fresh blood with plenty of chylomicrons. The right half of the field is under the dark-field microscope and the left half under the bright-field microscope, the objectives, oculars, and magnification being the same in both. This figure shows the greatly increased visibility of minute objects in the dark field.

naturally be modified by the fat not in chylomicron form as well as by the chylomicron fat.

In the studies here reported, the majority of the infants were not given any feeding at 6 a. m. At 9 a. m. the chylomicrons were counted.

At 10 a. m. the infants were fed, and directly after this feeding and every hour after the feeding for four hours a similar count was made. With few exceptions, a period of eight hours had elapsed between feedings. Every child had been at least twenty-four hours on the formula which was studied.

DATA FROM INFANTS FED ON HUMAN MILK

Six premature babies and one marasmic infant, all of whom were receiving breast milk, showed a higher average number of chylomicrons

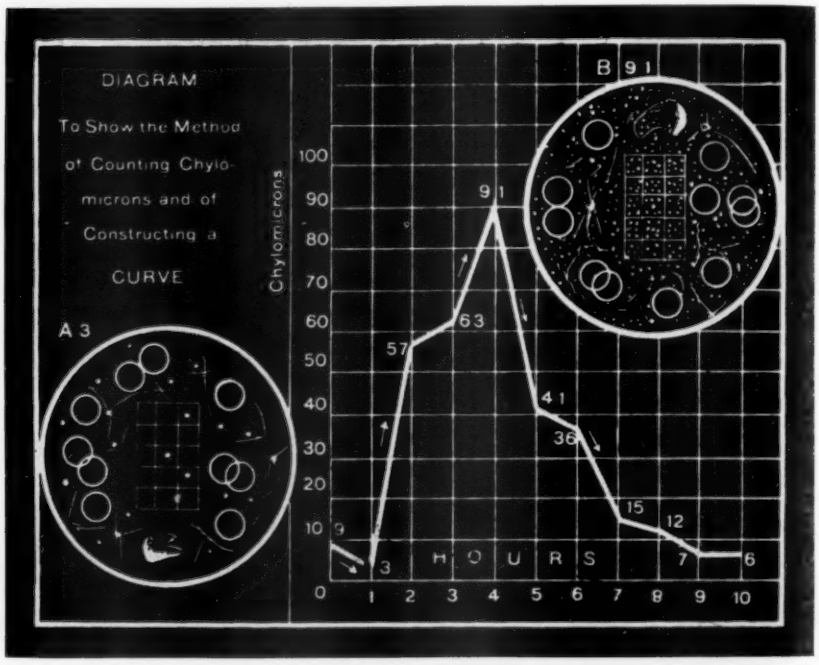

Fig. 3.—Chylomicron curve and two microscopic fields, to show how the data for the curve were obtained. At the lowest point of the curve there were only three chylomicrons in the net micrometer, and at the peak of the curve, ninety-one. The numerals along the curve show in the same way how many chylomicrons were in the net micrometer at the different hours of the experiment. It will be noted that the number at the beginning was nine, and at the end of the first hour the number was three. This means that the previous meal had not been completely assimilated when this experiment began.

than was obtained from any other feeding except from the butter-flour mixture. The peak of the absorption curve was reached in two hours in four cases, in three hours in two cases and one had the highest count after having had nothing but water for seven hours. This was the oldest infant (aged 4 months), and as a similar result was obtained in at

least one instance with every kind of formula, it is desirable to consider this point separately.

Gage and Fish [4] have shown that the time required for a given kind and quantity of fat to be digested, absorbed and to disappear from the blood with any given person or animal, varies from about six to ten hours.

They have also shown that mental, emotional or physical strains influence digestion. When one of these conditions intervenes, the normal peak-like curve may be broken up.

In all the infants studied, no matter what type of feeding was employed, the time required for the digestion cycle in by far the vast majority was under four hours. Why do a few show the highest peak at the end of an eight hour fast, when the intake had been limited to water?

TABLE 1.—*Digestive Cycle on a Premature Infant Fed Human Milk*

L., aged 2½ months, weighed 3 pounds, 14½ ounces. Premature. Formula: Breast milk, 1½ drams every three hours.

Clock Time	Hour	Chylomicrons in Five Fields					Totals	Average	Hour
		1	2	3	4	5			
9 Fed		No count made							
10	1	15	21	18	16	18	88	17.6	1
11	2	38	45	45	46	42	216	43.2	2
12 Fed	3	24	31	25	27	26	133	26.6	3
1	1	18	10	12	13	17	68	13.6	1
2	2	12	10	16	15	14	67	13.4	2

Is it possible that the extra physical activity and emotional distress, such as might be induced by the crying and restlessness due to a passed feeding time, called forth fat which had already been mobilized in the body? It is known that the chylomicron curve is practically a straight line at the zero level during fasting with adults, but that if vigorous exercise is taken, a characteristic up-and-down curve is added. Gage's interpretation of this is the only logical one. He says: "In the ordinary activity of a fasting animal or man, the fat is poured into the blood from the fat reservoirs only as it is needed and at the rate it is needed. The more energy expended means a larger amount of fat to supply the energy."

Unfortunately, no notes of restlessness or crying in the infants studied were made, and while the explanation made seems attractive, the question for the present at least must remain in abeyance.

Table 1 illustrates the absorption curve of the fat of human milk.

Babies fed on breast milk seem to reach the peak of their absorption curve, on the average, sooner than on any other feeding which was given. This might be interpreted as showing a more rapid, and, by inference, the absorption of a larger percentage of the fat content, but it must be

borne in mind that the up-and-down sides of the curves result from two opposing factors. The curve goes up if fat is added to the blood faster than it is eliminated, and it goes down if the elimination is greater than the addition. It can then be understood that if the elimination of free fat from the blood stream is equal to the addition to it, we would have no increase of chylomicrons in the blood, although the fat might be digested and our curve would be a straight line.

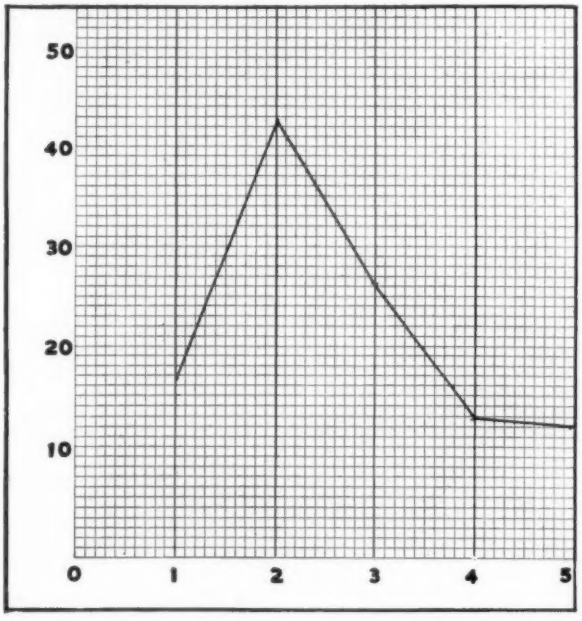

Fig. 4.—The chylomicron (free fat) content of the blood in infants, showing the peak of the curve reached in two hours when fed on breast milk. In Figures 4, 5, 6 and 7, the horizontal figures represent the number of hours after the feeding when the chylomicrons were counted; the vertical figures represent their number.

COW'S MILK DILUTIONS

Forty-three curves of the digestive cycle were made from a study of twenty-two children fed on cow's milk dilutions. Their ages varied from 3 weeks to 11 months.

Of the forty-three curves fifteen reached their peaks in two hours, fifteen in three hours, ten in four hours and one in five hours, while two had the largest chylomicron content in the beginning. One of these had had a feeding four hours before, which may have accounted for the high figure.

Marked variations have been observed, not only in the number of chylomicrons, but in the rate which they enter the blood stream.

Table 2 includes two counts on a normal infant taken ten days apart. It will be noted that the second formula has 2 ounces more of milk.

It will be seen that the blood was practically free of chylomicrons after an eight hour interval between feedings, but the number of chylomicrons present after the second feeding was much less than after the feeding studied ten days previously. If any connection exists between the stationary weight and the apparent failure to absorb the fat, it is a question which admits only of conjecture. There is also the further possibility that at this particular time the elimination paralleled the addition.

TABLE 2.—*Digestive Cycle on a Normal Infant Fed Cow's Milk*

E., aged 1 month, weighed 8 pounds, 7 ounces. Formula: Cow's milk, 13 ounces; dextrimaltose, 1¼ ounces; water, 14 ounces. Time last fed, 2 a. m.

Clock Time	Hour	Chylomicrons in Five Fields					Totals	Average	Hour
		1	2	3	4	5			
10 Fed		No counts made							
11	1	11	12	14	16	15	62	12.4	1
12	2	10	15	20	15	14	74	14.8	2
1 p. m.	3	5	6	10	10	7	38	7.6	3
2	4	2	1	0	1	1	5	1.0	4

Counts made ten days later on the same infant. Formula: Cow's milk, 15 ounces; dextrimaltose, 1½ ounces; water, 15 ounces. Time last fed, 2 a. m.

Clock Time	Hour	Chylomicrons in Five Fields					Totals	Average	Hour
		1	2	3	4	5			
9 a. m.	0	2	1	0	1	1	5	1.0	0
10 Fed	0	0	1	1	1	0	3	0.6	0
11	1	5	3	4	2	5	19	3.8	1
12	2	3	3	2	0	1	9	1.8	2
1 p. m.	3	5	4	6	7	5	27	5.4	3
2	4	0	1	2	0	1	4	0.8	4

The very young infants seemed to show the most marked variation. Figure 5 shows five curves from the same infant, three weeks old, fed on cow's milk diluted. These were taken at approximately four day intervals, and the averages varied from four to forty-six chylomicrons, though the peak was reached in four of the five counts by the third hour.

The variations in no way militate against the very evident fact shown in the studies that, following the ingestion of milk, the infant usually shows a distinct rise in the chylomicron content of the blood and a subsequent decline. The rise is an index to the relative rate to which fat is being poured into the blood, just as the fall indicates the relative rate at which it is being removed from the blood.

It is necessary to recall, as Gage and Fish have pointed out, that in interpreting the chylomicron counts we must consider at least five differ-

ent processes which may be going on in the body during the digestive cycle, namely:

1. Digestion. 2. Absorption. 3. The movement of the absorbed fat along the lacteal glands through the mesenteric lymph nodes to the thoracic duct into the blood stream. 4. Assimilation of the fat after it reaches the blood stream. 5. Metabolism of fat.

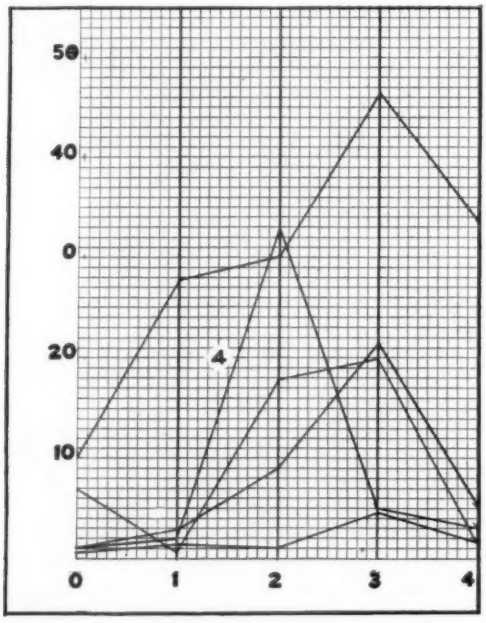

Fig. 5.—The variations in the chylomicron content in a young infant. The five curves were constructed from data from the same infant, who was fed approximately on the same cow's milk formulas each time. The most constant feature was the fact that the peak of the curve was reached in three hours, irrespective of the chylomicron content. Curve 4 shows the one variant peak was reached in two hours, and came down practically to the zero level by the end of the third hour.

That these processes in infants proceed at their best during the digestion of human milk is admitted, and the absorption of fat in the infants fed on cow's milk is apparently slower compared with the fat of those fed on human milk.

SKIM MILK AND BUTTER-FLOUR MIXTURES

The most striking illustration of the fact that the fat content of the formula is responsible for the number of chylomicrons present, is afforded by a comparison of the counts on an infant fed skim milk dilutions and then changed to a butter-flour formula.

TABLE 3.—*Curves on a Well Infant Fed Respectively on a Skim Milk Formula and Two Days Later on a Butter-Flour Formula*

F. H., aged 3 months, a well infant, weighed 9 pounds, 10 ounces. Formula: Fat-free milk, 16 ounces; dextrimaltose, 1¼ ounces; water, 14 ounces. Five ounces every four hours. Last fed, 2 a. m.

		Chylomicrons in Five Fields							
Clock Time	Hour	1	2	3	4	5	Totals	Average	Hour
9 a. m.		0	1	1	0	1	3	0.6	
10 Fed	0	0	1	2	0	1	4	0.8	0
11	1	0	0	0	1	0	1	0.2	1
12	2	3	4	3	1	2	13	2.6	2
1 p. m.	3	0	0	1	1	0	2	0.4	3
2	4	0	1	2	1	2	6	1.2	4

Two days later, this formula was changed to buttermeal, 16 ounces; milk 12 ounces, and the following data were obtained:

		Chylomicrons in Five Fields							
Clock Time	Hour	1	2	3	4	5	Totals	Average	Hour
9 a. m.		4	5	4	3	5	21	4	
10 Fed	0	4	4	5	3	5	21	4	0
11	1	5	6	5	4	4	24	2	1
12	2	35	30	26	24	25	130	26	2
1 p. m.	3	112	95	98	110	102	517	103	3
2	4	118	125	121	117	115	596	119	4
3	5	78	74	72	80	82	386	77	5

These were the highest figures obtained at any time in the study. Further confirmation of the fact that the butter in the formula is responsible is gained by a comparison of two groups of infants, one fed on fat-free milk, the other on butter-flour mixtures.

Of six children fed on fat-free milk dilutions, the average count showed but six chylomicrons at the peak of the curve which was usually reached by the third hour, while the average of five infants having butter-flour was eighty-two, reached as a rule between the third and fourth hour.

From the point of digestibility, butter in the form of the butter-flour mixtures seems to be a desirable addition to infants' formulas.

DRIED MILK FORMULAS

Six infants who were fed on dried milk formulas at the end of the third hour showed an average chylomicron content of twenty, with extremes of thirty-eight and five. Their rate of absorption seemed, on the whole, to be a little more rapid than that of those who were fed cow's milk, but the average number of chylomicrons was proportionate to the amount of fat in the formula.

Table 4 is the average for the babies fed on dried milk.

THICK CEREAL MIXTURES

The addition of large amounts of cereal to skim and whole cow's milk, as is done in the thick cereal mixtures, seemed to increase slightly the average number of chylomicrons.

Six children fed on thick cereal mixtures made with skim milk furnished data for ten curves. The average chylomicron content at the peak of the curve was ten, reached usually in three hours. This is four above the average on those fed skim milk dilutions without cereal, but this difference might easily have been due to the variations attendant on the fat content of the ordinary skim milk used in an infant's feeding ward.

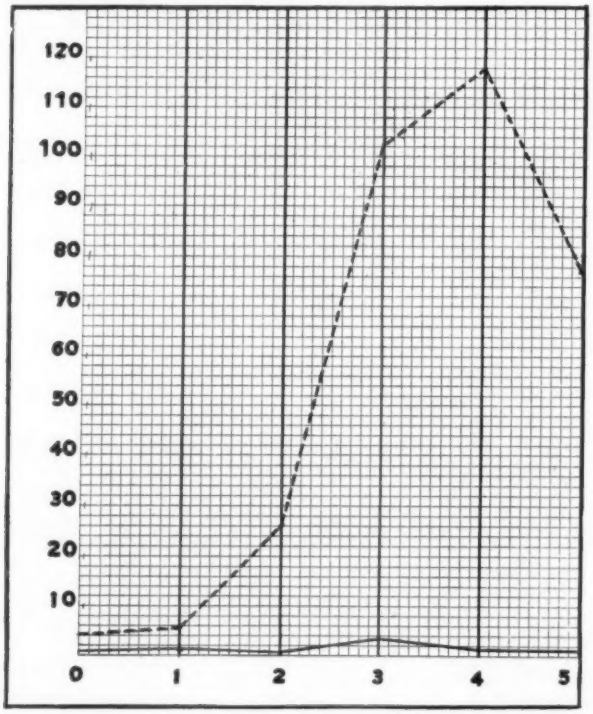

Fig. 6.—The difference in the chylomicron content on a skim milk formula and a butter-flour mixture. The straight line represents the skim milk and the broken line the butter-flour. The infant was a well child, aged 3 months. Two days separated the counts.

TABLE 4.—*Curve of Infant Fed on Dried Milk*

M. A., aged 1½ months, a well child, weighed 6 pounds, 13 ounces. Formula: Dried milk, 2 level tablespoons; dextrimaltose, 1½ teaspoons; water, 4 ounces. Fed every four hours. Time since last feeding eight hours.

		Chylomicrons in Five Fields							
Clock Time	Hour	1	2	3	4	5	Totals	Average	Hour
9 a. m.	0	3	6	3	4	5	21	4.2	0
10 Fed	0	1	0	2	2	2	7	1.2	0
11	1	12	14	10	13	9	58	11.6	1
12	2	28	26	30	25	27	136	27.2	2
1 p. m.	3	18	19	18	16	20	91	18.2	3
2 Fed	4	4	7	4	5	5	25	5.0	4
3	5	2	1	0	1	1	5	1.0	5

THE EFFECT OF SUGAR ON THE CHYLOMICRON CONTENT

The addition of sugar to skim milk dilutions does not increase the chylomicron content. Five infants were fed skim milk dilutions, with gradually increasing amounts of dextrimaltose. In no case was there an increase. Table 5 illustrates this.

TABLE 5.—*Data for Curves on a Well Infant*

L. E., aged 1 month, weighed 8 pounds, 7 ounces; a well infant. Formula: Skim milk dilution with 3.5 per cent. dextrimaltose added. Hours since last feeding, eight.

		Chylomicrons in Five Fields							
Clock Time	Hour	1	2	3	4	5	Totals	Average	Hour
9 a. m.	0	0	0	0	1	1	2	0.4	0
10 Fed	0	1	0	0	1	1	3	0.6	0
11	1	3	3	2	2	4	14	2.8	1
12	2	1	0	0	2	1	4	0.8	2
1 p. m.	3	2	1	0	2	0	5	1.0	3
2	4	1	1	1	0	0	3	0.6	4

Ten days later on the same formula, except that 10 per cent. of dextrimaltose had been added, the following data were obtained:

		Chylomicrons in Five Fields							
Clock Time	Hour	1	2	3	4	5	Totals	Average	Hour
9 a. m.	0	0	1	0	0	1	2	0.4	0
10 Fed	0	0	0	1	0	0	1	0.2	0
11	1	0	1	0	0	1	2	0.4	1
12	2	1	2	2	1	1	7	1.4	2
1 p. m.	3	3	2	2	4	5	16	3.2	3
2	4	0	1	1	0	2	4	0.8	4

This table appears to confirm Gage's findings that sugar does not increase the chylomicron content.

THE EFFECT OF COD LIVER OIL AND OLEOMARGARINE

The addition of cod liver oil to the diet increased the chylomicron content, with one exception. Oleomargarine fed to four children from whom data for eight curves were constructed had little or no effect. This is contrary to Gage's experience with adults, and is worth considering. Practically all margarine formulas are trade secrets, and a great variety exists. The oleomargarine which was used in these experiments was composed, according to the manufacturer of oleic acid from beef fat, peanut oil, neutral lard from beef, milk and salt. The percentages could not be obtained.

From 0.5 to 1 gm. of this oleomargarine was added to each bottle feeding of two infants under 1 month of age, to one, aged 4 months and to one, aged 7 months. Two were not sick, one had rickets and the other had otitis media.

Of the eight counts made, only one showed a peak of more than ten chylomicrons, while the seven other curves indicated no digestion of

absorption. It is possible that infants do not digest oleomargarine readily, or this particular brand had no fatty substances capable of absorption.

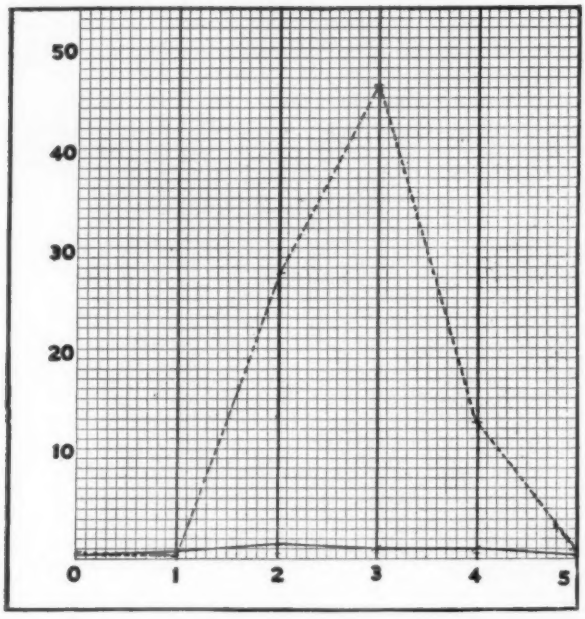

Fig 7.—The effect of the addition of cod liver oil to a fat free cow's milk dilution. The straight line represents the number of chylomicrons in the fat free formula, and the broken line the number after cod liver oil had been added. Not all the infants, however, showed such a marked increase.

TABLE 6.—*Curve on an Infant Fed Cod Liver Oil*

E. M., aged 2½ months, weighed 5 pounds, 5 ounces. Formula: Fat-free milk, 10 ounces; dextrimaltose, 1 ounce; water, 8 ounces. Time since last feeding, 8 hours.

		Chylomicrons in Five Fields							
Clock Time	Hour	1	2	3	4	5	Totals	Average	Hour
9 a. m.	0	0	1	0	0	1	2	0.4	0
10 Fed	0	1	0	1	1	1	4	0.8	0
11	1	1	2	2	1	0	6	1.2	1
12	2	1	1	1	1	1	5	1.0	2
1	3	2	1	1	0	1	5	1.0	3
2	4	0	0	1	1	0	2	0.4	4

Adding 15 drops of cod liver oil to three bottles daily, continuing the same formula, gave the following results:

		Chylomicrons in Five Fields							
Clock Time	Hour	1	2	3	4	5	Totals	Average	Hour
9 a. m.	0	0	1	0	0	1	2	0.4	0
10 Fed	0	0	1	0	0	2	3	0.6	0
11	1	28	25	28	30	30	141	28.2	1
12	2	48	51	46	47	44	236	47.2	2
1 p. m.	3	12	14	17	13	12	68	13.6	3
2	4	2	0	1	1	0	4	0.8	4

The difference between the absorption of cod liver oil and the oleomarmargine employed is well illustrated in the curves constructed from a study of Tables 6 and 7.

Not only was there an increase in the chylomicrons but the fact that the peak of the curve was reached two hours after the feeding indicated rapid digestion and absorption.

That cod liver oil does not always increase the chylomicron content would seem to be indicated by a study of the data obtained from H. S. (Table 7), who had rickets. His formula was made from fat-free milk. Three times a day 15 drops of cod liver oil were given, but the count showed no chylomicron increase.

TABLE 7.—*Infant Fed Cod Liver Oil Who Showed no Increase in Chylomicron Content*

H. S., aged 5 months. Diagnosis: Rickets. Formula: Fat-free milk, 18 ounces; dextrimaltose, 0.5 ounce; water, 12 ounces; cod liver oil, 15 drops three times a day. Hours since last feeding, 8.

		Chylomicrons in Five Fields							
Clock Time	Hour	1	2	3	4	5	Totals	Average	Hour
9 a. m.	0	3	1	0	2	1	7	1.4	0
10 Fed	0	2	3	2	2	1	10	2.0	0
11	1	1	2	0	0	0	3	0.6	1
12	2	3	5	8	4	4	24	4.8	2
1 p. m.	3	3	1	3	2	5	14	2.8	3
2	4	3	1	2	3	2	11	2.2	4

That marked variations must exist in the digestion of fat is indicated by a further study of H. S. Six days after, he failed to show any chylomicron increase from the addition of cod liver oil, the formula was changed from fat-free milk to whole milk and at once there was a decided increase in the chylomicron content.

TABLE 8.—*Infant Fed Whole Milk Dilution*

H. S., aged 5 months. Formula: Whole cow's milk, 18 ounces; dextrimaltose, 0.5 ounce; water, 12 ounces. Hours since last feeding, 8.

		Chylomicrons in Five Fields							
Clock Time	Hour	1	2	3	4	5	Totals	Average	Hour
9 a. m.	0	2	3	1	2	2	10	2.0	0
10 Fed	0	2	3	3	2	2	12	2.4	0
11	1	2	3	2	2	3	12	2.4	1
12	2	21	21	20	23	20	105	21.0	2
1 p. m.	3	27	27	30	31	31	146	29.2	3
2	4	2	4	3	5	2	16	3.2	4

While this infant (Tables 6 and 7) showed no increase from cod liver oil but did when whole cow's milk was substituted for fat-free milk, may be explained on the basis stated previously, that it is possible to have no increase if the elimination equals the addition, but further study is clearly indicated. All that can be said with certainty is that the addition of cod liver oil in rickets is not always followed by a rise in the chylomicron content.

No marked increase was shown in any of the infants to whose feedings oleomargarine was added, and while the infant in Table 9 had rickets, the curve is typical of those obtained.

TABLE 9.—*Infant Fed Fat-Free Milk to Which Oleomargarine Was Added*

A. V., aged 7 months, weighed 11 pounds, 9 ounces. Diagnosis: Rickets. Formula: Fat-free milk, 24 ounces; dextrimaltose, 1½ ounces; water, 11 ounces. Seven ounces, five bottles daily. To each bottle was added 1 gm. of oleomargarine. Hours since last feeding, 8.

		Chylomicrons in Five Fields							
Clock Time	Hour	1	2	3	4	5	Totals	Average	Hour
9 a. m.	0	6	4	7	4	5	26	5.2	0
10 Fed	0	2	2	3	3	2	12	2.4	0
11	1	3	0	1	2	2	8	1.6	1
12	2	2	2	3	1	2	10	2.0	2
1 p. m.	3	4	2	3	5	6	20	4.0	3
2 Fed	4	1	2	0	3	1	7	1.4	4
3	5	8	8	5	7	8	36	7.2	5

THE EFFECT OF ETHER ON THE CHYLOMICRON CONTENT

In an attempt to shed some light on the question as to whether or not etherization for operation increases the free fat in the blood, seventeen children, varying in age from 4 months to 12 years, were studied.

All of these children received ether by the open method; all were fasting and all had minor operations performed (four circumcisions, thirteen tonsillectomies).

The chylomicrons were counted immediately before the operation, at the close of the operation and from one-half to three-quarters of an hour later. Table 10 gives the result.

TABLE 10.—*The Effects of Ether on Chylomicrons*

			Number of Chylomicrons		
Name	Age	Operation	Before Operation	Immediately After	After ½ to ¾ Hour
F. I.	4 mo.	Circumcision	1.6	1.6	5.4
J. S.	14 mo.	Circumcision	6.2	14.4	5.0
R. G.	16 mo.	Circumcision	2.8	21.4	4.4
C. O.	2 yr.	Tonsils and adenoids	3.4	0.8	0.4
J. K.	2 yr.	Tonsils and adenoids	6.6	2.8	4.0
C. M.	2 yr.	Tonsils and adenoids	4.2	1.8	0.4
M. E.	3 yr.	Tonsils and adenoids	0.2	7.4	4.4
L. D.	3 yr.	Tonsils and adenoids	0.6	0.6	0.6
O. J.	4 yr.	Tonsils and adenoids	1.2	2.4	0.4
J. D.	5 yr.	Tonsils and adenoids	0.4	0.0	0.2
E. Q.	5 yr.	Circumcision	4.2	0.8	1.0
R. C.	6 yr.	Tonsils and adenoids	1.4	0.6	0.8
M. W.	7 yr.	Tonsils and adenoids	1.2	21.4	6.2
M. B.	7 yr.	Tonsils and adenoids	1.2	0.2	0.2
S. L.	11 yr.	Tonsils and adenoids	4.2	1.8	0.4
J. B.	11 yr.	Tonsils and adenoids	2.0	1.4	0.0
A. M.	12 yr.	Tonsils and adenoids	1.4	0.2	0.2

Narcotics are said to increase blood fat. The explanation offered is that the mixture of ether and blood has a higher solvent power for fat than has blood alone.

Mary Gage Day [6] studied the chylomicrons in the blood of men and dogs during ether anesthesia and found a decrease in every case studied; she concluded that instead of being an ether lipemia there is an actual decrease in the number of fat particles.

Of the seventeen cases here reported, thirteen showed an actual decrease and four an appreciable rise, but these four showed a very rapid decrease within an hour.

SUMMARY

The study of the chylomicron content of infants' blood shows that it is increased in proportion to the fat content of the food. Greater variations in the digestion and absorption of fat seem to take place in infants than in adults.

The addition of cod liver oil usually increases the chylomicron content of the blood, but in one case of rickets such an increase was not found.

Oleomargarine caused no marked increase in the chylomicron content in infants under 4 months of age, but until the exact proportions of the various ingredients in the various brands are known, no conclusions can be drawn.

Butter, as added in the butter-meal mixtures, is rapidly digested and absorbed, and these mixtures gave the highest chylomicron content in this series.

Ether anesthesia does not cause a rise in the chylomicron content of the blood.

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6. Day, M. G.: Some Studies of the Blood Before and After Etherization by the Drop Method, Am. J. Surg. **36**:53-57 (April) 1922.

INDEX OF REFRACTION OF BREAST MILK SERUM *

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In pediatric institutions, so much breast milk is now used for infant feeding that to obtain it from resident wetnurses is no longer always practical. Instead, many institutions purchase breast milk from mothers who deliver it in sterile containers. Breast milk is also being handled in the dried form. With this universal demand, the commercial production and distribution of mothers' milk is fast assuming the proportions of an industry. Chapin [1] describes "breast milk dairying." Hoobler [2] states that the output from the Detroit bureau of wetnurses for the last ten years has been 414,000 ounces, at the average price of 18 cents an ounce. Kappeller and Gottfried [3] report that in the small town of Magdeburg 431 liters of breast milk were used in a period of six months. They point out that with a large market for human milk, the danger arises that unscrupulous mothers may dilute the breast milk with water or with cows' milk. A simple method for the detection of such adulteration or fraud is, therefore, desirable.

METHODS

Several methods have been proposed by German workers, but they are not sufficiently practical. In the order of increasing importance for our purpose, the following methods are available: (1) Biologic or serologic; (2) method of Umikoff; (3) method of Tugendreich; (4) method of Bauer; (5) method of Moro; (6) method of Edelstein; (7) method of Meyer, and (8) method of Gottfried and Kappeller.

The biologic methods include the precipitin reaction, the anaphylactic reaction, and complement fixation. These serve only for the detection of foreign milk in breast milk and are not quantitative. They do not show the addition of water, and are complex and time consuming.

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* Received for publication, Oct. 12, 1925.

* From the Department of Pediatrics, School of Medicine, Yale University.

* Thesis done in partial fulfilment for the degree of M.D., June, 1925.

1. Chapin, H. D.: The Operation of a Breast Milk Dairy, J. A. M. A. **81:** 200 (July 21) 1923.

2. Hoobler, B. R.: Human Milk, Its Commercial Production and Distribution, J. A. M. A. **84:**165 (Jan. 17) 1925.

3. Kappeller, G., and Gottfried, A.: Nachweis von Kuhmilch in Frauenmilch, München. med. Wchnschr. **67:**813 (July 9) 1920.

The methods of Umikoff, Tugendreich, Bauer and Moro are chemical in nature. Umikoff [4] adds ammonia to the milk and heats to 60 C. Breast milk gives a reddish violet to a dark violet color, cows' milk gives a light yellow to a brownish color or no color change at all. Mixtures of cows' milk and breast milk give shades difficult to distinguish. Color changes are used also by Tugendreich.[5] The reagent is silver nitrate. The Bauer [6] reaction is similar, the reagent being Nile blue sulphate. Moro's [7] neutral red reaction also depends on color changes. None of these methods, however, detects adulteration of breast milk. They serve only for gross differentiation between pure cows' milk and pure breast milk.

Breast milk has a higher milk sugar content and a lower protein content than cows' milk. Edelstein [8] treats the lactose serum of breast milk and cows' milk with a copper solution. The reduction of this solution by the sugar produces distinctly different colors in the two kinds of serums. He also determines the amount of colloidal iron hydrate required for quantitative precipitation of the protein. In this way, 20 per cent. of water and 30 per cent. or more of cows' milk can be detected. The method requires, however, from 30 to 50 c. c. of milk and is somewhat elaborate and slow.

Meyer [9] employs two different tests. The first depends on the difference in acid-combining properties between cows' milk and breast milk; the second, the difference in their coagulation temperatures. Theoretically, these methods are sound. Practically, they require the preliminary establishment of normal standards for the milk of each mother and are too exacting for general use.

The index of refraction of the serum of breast milk differs from that of cows' milk. Kappeller and Gottfried [3] make use of this distinction in the method which they have devised for the differentiation of cows' milk and of human milk. The use of the index of refraction was suggested to them by Phyl and Turnau,[10] who worked with cows' milk and advised carbon tetrachlorid and acetic acid for preparing the serums. Kappeller and Gottfried [3] found that those reagents could

4. Umikoff, N.: Sur differenziellen Chemischen Reaktion der Frauenmilch und Kuhmilch, Jahrb. f. Kinderh. **42**:356, 1896.

5. Tugendreich, G.: Eine Reaktion zur Unterscheidung von Frauenmilch und Kuhmilch, Berl. klin. Wchnschr. **5**:244, 1911.

6. Bauer: Ueber eine Reaktion zur Unterscheidung von Kuh und Frauenmilch, Monatschr. f. Kinderh. **11**:474, 1913.

7. Moro, E.: Ueber die Neutralrotreaktion der Milch, München. med. Wchnschr. **59**:2553, 1912.

8. Edelstein, F.: Zur Prüfung der Frauenmilch Verfalschung, Ztschr. f. Kinderh. **30**:326 (Nov.) 1921.

9. Meyer, H.: Eine Neue Methode zum Nachweis von Frauenmilchverfalschung, Arch. f. Kinderh. **75**:211 (Feb.) 1925.

10. Phyl and Turnau, Sommerfeld, cited by Hoobler, B. R.: 1909, p. 20.

not be used for the serums of human milk. The method of Engel,[11] to separate the protein from cows' milk with acetic acid, was not suitable, because dilution of the milk caused too great a change of the refractive index. After much experimentation, Kappeller and Gottfried evolved the following successful method.

> To 20 c.c. of milk, add 10 drops of 20 per cent. acetic acid. Warm the mixture in a hot water bath at 40 C. for at least thirty minutes. Prevent loss through the evaporation of water by carefully covering the beakers. After cooling to room temperature, a clear serum is obtained. This is filtered. The index of refraction is determined at 17.5 C. by the Zeiss immersion refractometer.

Kappeller and Gottfried summarize their results as follows:

> The serum of breast milk is considerably higher than that of cows' milk in the degree of refraction of light. By addition of cows' milk, the index of refraction of breast milk is lowered. Water also considerably lowers the index of refraction of breast milk. From the few tests done, it can be seen that a 20 per cent. addition of cows' milk and a 10 per cent. addition of water can be detected.

The objections to this method are: (1) that it takes about one hour to do a test; (2) care must be taken to prevent loss of serum through evaporation, and (3) much material (20 c. c.) is required. The advantages are that it distinguishes between cows' milk and breast milk and also detects added water. Our method is a simplification of theirs in the preparation of the milk serum, and involves the same principle.

MATERIALS USED

The milk used for our tests was obtained from mothers in whom lactation had been fully established, as they are the most favorable sources of supply of milk for commercial purposes. We also tested a number of samples from women in whom lactation had been newly established (from six to fourteen days postpartum). In several instances we were able to collect the fore-milk, mid-milk and strippings. The cows' milk used was pasteurized Grade A and Grade B milk from local dairies.

REAGENT

Milk samples were treated with various reagents in an attempt to get clear serums. The acetic acid and copper sulphate methods recommended by Leach[12] for cows' milk were tried but abandoned. Clear filtrates were obtained from breast milk with copper sulphate solution only after the addition of fuller's earth, but filtration was slow and

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11. Engel: Eine Neue Methode der Quantitiven Abscheidung des Caseins aus genuiner Frauenmilch, Biochem. Ztschr. **14**:234, 1908.
12. Leach: Food Inspection and Analysis, Ed. 4, New York, John Wiley, 1920, p. 150.

unsatisfactory. We then tried the method used by Castellani [13] in the preparation of cows' milk serum. She proposed adding 0.5 c. c. of a 250 per cent solution of mercuric nitrate, acidified with the smallest amount of nitric acid to 50 c. c. of milk, and reported that clear filtrates were obtained. We found that a 250 per cent. mercuric nitrate solution could not be readily prepared. However, much weaker solutions (5, 10 and 20 per cent.), acidified with minimum amounts of concentrated nitric acid, yielded clear serums both of cows' milk and of breast milk. This reagent for precipitating protein, previously suggested by Wiley,[14] we adopted as suitable for preparation of the serums.

We then studied the refractometer readings and found that, when prepared under identical conditions, the serums of human milk always gave readings distinctly higher than those of cows' milk. The next step was to standardize the conditions.

We therefore, determined the optimum for: (*a*) Concentration of mercuric nitrate; (*b*) amount of acid added; (*c*) amount of reagent used; (*d*) temperature, and (*e*) amount of milk required.

Our criteria of the reagent to be used were that: (1) It should yield clear serums; (2) it should permit rapid filtration; (3) it should yield adequate amounts of filtrate, and (4) its index of refraction and that of filtrate should be as nearly alike as possible.

METHOD

Several solutions of mercuric nitrate of varying concentration and acidity were added to the milk, agitated, then protein allowed to precipitate and the clear serums filtered into refractometer cups. The index of refraction was read in scale degrees on the Zeiss immersion refractometer at 20 C. The instrument is fully described by Leach.[15] The data obtained are assembled in accompanying tables.

Concentration.—Reagents varying from 2.5 to 20 per cent of mercuric nitrate, acidified with minimum amounts of nitric acid (with a specific gravity of 1.42) were prepared and their indexes of refraction at 20 C. were determined. Table 1 shows that the index of refraction of the reagent varies with its concentration of mercury. Doubling the concentration of mercuric nitrate, with the amount of acid constant, caused an increase in the index of refraction of the solution of, roughly, 50 per cent. Two cubic centimeters of these reagents were added to 10 c. c. of milk or breast milk.

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13. Castellani, M.: "A Refractive Index Method for the Detection of Watering of Milk," Ann. Chem. **13**:14, 1923.

14. Wiley, H. W.: Determination of Lactose of Milk by Optical Methods, Am. Chem. J. **6**:289-302, 1884.

15. Leach: Footnote 12, pp. 99-107.

The precipitation and filtration were satisfactory with the 10 and 20 per cent. solutions. With the 2.5 per cent. solution filtration was slow and the filtrate was turbid in all cases. The 2.5 per cent. solution was, therefore, discarded. The 5 per cent. solution was also unsatisfactory (Table 2). Examination and study of the data in Table 3 reveal that the index of refraction of the breast milk serum falls with increasing amounts of the 5 per cent. reagent. With increasing amounts of 20 per cent. reagent, the index of refraction rises. With increasing or

TABLE 1.—*The Index of Refraction Varies with the Concentration of the Mercuric Nitrate*

Concentration of Mercuric Nitrate, per Cent.	Acidity in C.c. of Concentrated HNO_3 per Liter of Reagent	Index of Refraction at 20 C.
2.5	16	22.2
5.0	16	31.4
10.0	16	44.5
20.0	32	73.0

TABLE 2.—*The Effect of Different Concentrations of Mercuric Nitrate on the Filtrability of the Serums; also of Variations in the Acidity on the Filtrability of the Serums and the Index of Refraction of Reagent and Serums. Reagent 2 cc.; Milk 10 cc.*

Acidity in C.c. of HNO_3 per 1000 C.c. of Reagent	Index of Refraction of Reagent	Index of Refraction of Cows Milk Serum	Index of Refraction of Breast Milk Serum
A. Reagent Used, 2.5% Mercuric Nitrate			
5	20.5	Turbid	Turbid
8	21.2	Turbid	Turbid
16	22.2	Turbid	Turbid
B. Reagent, 5% Mercuric Nitrate			
10	30	Turbid	38.2
16	31.4	33.8	39.4
20	32.5	34.5	40.6
C. Reagent, 10% Mercuric Nitrate			
16	44.5	34.2	41.9
20	45.7	34.6	42.2
30	46.8	35.2	42.4
D. Reagent, 20% Mercuric Nitrate			
32	73.0	38.5	46.9
40	75.3	39.5	47.4
60	80.7	41.1	49.0

varying amounts of 10 per cent. reagent, the index of refraction of the breast milk serum varies but slightly.

The 10 per cent. reagent was selected because it best fulfils our criteria. It rapidly yields clear serum in adequate amount, and has an index of refraction nearest to that of breast milk.

Amount of Acid Added.—The addition of nitric acid to the reagent was next studied. Mercuric nitrate will not go into solution unless nitric acid is present. Varying amounts of acid were, therefore, added, and the effect on the index of refraction of the reagent and of the serums was studied. These data are compiled in Table 2. Added acid

increases the index of refraction of the reagent slightly. Doubling the acid, when the concentration of the mercuric nitrate remains constant, raised the index of refraction of the reagent from 1.7 to 2.3 degrees, except in the case of the 20 per cent. reagent, when it raised the index 7.7 degrees. The effect on the index of refraction of the serums was very slight (from 0.5 to 2.6 degrees increase). The conclusion seems justified that the concentration of the mercuric nitrate is the main factor and the added acid a subordinate one, the fine adjustment, in determining the index of refraction of the reagent and of the serum.

When used to prepare the serums, the addition of acid improved filtration with the 5 per cent. reagent. In the 10 and 20 per cent

TABLE 3.—*The Concentration and Amount of Reagent of Choice. Milk 10 cc.*

	A. 5% Solution 16 C.c. Concentration of HNO_3 per 1000 C.c. Index of Refraction 30		B. 10% Solution 16 C.c. Concentration of HNO_3 per 1000 C.c. Index of Refraction 44.5		C. 20% Solution 32 C.c. Concentration of HNO_3 per 1000 C.c. Index of Refraction 73.5	
Amount	Index of Refraction of Cows' Milk	Index of Refraction of Breast Milk	Index of Refraction of Cows' Milk	Index of Refraction of Breast Milk	Index of Refraction of Cows' Milk	Index of Refraction of Breast Milk
1 c.c.	Very slow filtration; turbid filtrate	Slow filtration; turbid filtrate	Turbid filtrate	Slow filtration; slight turbidity	38.4 38.2	45.4 45.5
2 c.c.	34.4 33.4	39.2 39.1	34.2 34.4 34.6 34.1	41.9 42.3 42.5 42.4	39.5 39.7	47.5 47.8
3 c.c.	32.3 32.1	38.7 38.4	34.7 34.9	42.0 42.4 42.3 42.6	41.8 41.6	49.1 49.0
4 c.c.	31.4 31.3	37.6 37.8	35.2 35.4	42.4 42.8 42.9	43.8 44.1	51.2 50.9
5 c.c.	30.5 30.8	37.2 36.9	35.8 35.9	42.6 42.4 43.9 43.8	46.0 45.4	52.0 52.3

solutions, filtration was satisfactory with the minimum amounts of nitric acid and no advantage was noted with added amounts of acid. We, therefore, decided to use mercuric nitrate with a minimum amount of nitric acid as our standard solution.

Optimal Amount of Reagent.—The optimal amount of reagent remained to be determined. The aim was to find the smallest amount which consistently gave a clear, rapid filtration, and which could be varied most widely with the smallest change in the index of refraction. We, therefore, tried varying amounts of the 10 per cent. reagent, and also compared varying amounts of the 5 and 20 per cent. reagents. The data are given in Table 3. The milk was 10 c. c. in each test.

From Table 3 it can be seen that 2 c. c. is the smallest amount of reagent consistent with clear and rapid filtration. With the 20 per

cent. reagent, 1 c. c. was sufficient, but this yielded an insufficient amount of filtrate. With increasing amounts of the 10 per cent. reagent, the index of refraction of the serum of breast milk was increased but slightly, so that with this concentration inaccuracies in measuring out the solution are least serious. Two cubic centimeters of the 10 per cent. reagent, plus the amount of acidity chosen, 1.6 c. c. nitric acid per hundred cubic centimeters of reagent, fulfilled the conditions satisfactorily.

Temperature Variations.—In all our previous work, great care was taken to keep the temperature of the bath as nearly constant as possible, for it is well known that temperature plays an important rôle in the refraction of light. Since previous tables show that the variation in readings for the same serum should not exceed from 0.2 to 0.3 of a degree, it was necessary to find the variation of temperature compatible with that degree of accuracy. Cows' milk and breast milk

TABLE 4.—*The Effect of Temperature of Bath on Index of Refraction of Milk Serums*

Temperature of Bath in Degrees C.	Index of Refraction of Serum of Cows' Milk		Index of Refraction of Serum of Breast Milk	
15	36.1	36.2	44.6	44.8
17.5	35.0	35.1	43.8	43.9
20	34.1	34.1	42.7	42.8
22.5	33.5	33.3	41.9	41.9
25	32.8	32.6	41.0	41.1
27.5	32.0	32.0	40.1	40.2
30	31.2	31.3	39.4	39.3

were, therefore, treated with the reagent shown best as to concentration, acidity and amount, and the temperature varied between 15 and 30 C. at 2.5 degree intervals.

The data are given in Table 4.

This table shows that each degree of rise of temperature causes a lowering approximately of 0.3 degree on the refractometer scale. The accuracy in reading the instrument is from 0.1 to 0.2 degrees. Effort, therefore, must be made to keep the temperature of the bath constant within 0.5 C. We arbitrarily chose 20 C. as the temperature of the bath for all of our readings, because it is nearest to room temperature. If the readings are taken at temperatures other than 20 C., they may be corrected for this temperature by interpolation.

Amount of Milk.—The ratio of the reagent to the milk in all of our tests was 1:5. Keeping this ratio fixed, we found that the best amount of milk for a test was 10 c. c. Seven and one-half cubic centimeters is adequate, and 5 c. c. is the minimal amount necessary in order to obtain sufficient serum for refractometric readings with the macroprism. By use of the auxiliary prism, however, only one drop of the filtrate is required, and much smaller amounts of milk may be used, if necessary.

The optimum conditions are then as follows: (1) Concentration of mercuric nitrate, 10 per cent.; (2) acidity, 16 c. c. of concentrated nitric acid in 1,000 c. c.; (3) amount of reagent, 2 c. c.; (4) amount of milk, 10 c. c., and (5) temperature of bath, 20 C.

METHOD FOR OBTAINING READINGS

Preparation of Reagent.—Dissolve 100 grams of mercuric nitrate in about 500 c. c. of distilled water. Add 16 c. c. of concentrated nitric acid (specific gravity 1.43), agitate till dissolved (warming if necessary), cool, make up to a liter. The index of refraction of the reagent, as finally made up, should be 44.5 degrees at 20 C. The reagent is stable and keeps at room temperature for several months.

TABLE 5.—*The Indexes of Refraction of Cows' Milk and Breast Milk Serum*

Index of Refraction of Cows' Milk			Index of Refraction of Breast Milk		
33.2	33.2	32.9	42.6	42.6	42.1
34.2	33.2	32.4	42.0	42.5	42.6
32.2	33.9	33.4	43.4	43.4	42.3
34.3	34.1	33.8	43.9	43.3	43.1
34.6	33.9	34.2	42.8	43.4	42.9
33.6	34.2	32.5	42.2	43.6	42.8
32.9	34.3	33.2	42.4	42.2	42.2
33.1	34.2	32.9	42.2	42.6	42.1
33.4	34.1	33.6	42.1	43.1	42.1
33.2	32.6	33.4	43.1	42.6	42.8
32.9	34.3	33.2	42.9	43.3	42.9
33.8	33.6	32.9	43.4	43.2	42.7
33.4	32.2	33.6	43.1	43.2	42.9
33.7	33.3	33.1	43.2	42.3	42.1
33.1	33.4	33.4	42.6	42.8	42.1
33.2	33.6	32.8	42.4	43.6	42.1
33.4	34.4		43.1	42.7	42.7
			42.7	43.0	42.3
			42.0	42.3	42.4
Average of 50 samples, 33.4; high, 34.4; low, 32.2; error —1, +1.2; widest variation, 2.2			Average of 57 samples, 42.7; low, 42.0; high, 43.9; error —0.7, +1.2; widest variation, 1.9		

Procedure.—To 10 c. c. of milk in a small Erlenmeyer flask, add 2 c. c. of the before-mentioned reagent, shake thoroughly, allow to stand for one minute, filter, receive filtrate in refractometer cup and make reading with Zeiss immersion refractometer at 20 C. The values for unaltered cows' milk and breast milk are given in Table 5.

Degrees.—For breast milk the lowest index of refraction is 42.0 degrees and the highest is 43.9. The average of 57 samples is 42.7. The widest variation is 1.9 and the maximum variations from the average are plus 1.2 and minus 0.7. For cows' milk, the lowest readings are 32.2 and the highest 34.4. The average is 33.3. The widest variation is 2.2 and the maximum variations from the average are plus 1, and minus 1.2

A sharp variation exists between the breast milk serum and that of cows' milk. The highest reading for cows' milk serum is 34.4 degrees, and the lowest for breast milk serum 42.0. The smallest

TABLE 6.—*Results Found in Milk Samples*

	Index of Refraction, Degrees	Index of Refraction, Degrees
Fore-milk	42.8	43.0
Mid-milk	43.1	43.7
Strippings	41.9	43.1

TABLE 7.—*Index Refraction in Fifteen Samples*

Degrees	Degrees	Degrees	Degrees	Degrees
42.1	42.5	42.3	43.1	42.4
42.7	43.1	42.9	43.4	42.8
43.1	42.9	42.3	42.1	43.2

TABLE 8.—*The Effect of Addition of Cows' Milk on Index of Refraction of Breast Milk Serum*

Cows' Milk		Breast Milk		Index of Refraction of Diluted Milk Mixture	Percentage Adulteration
C.c.	Index of Refraction	C.c.	Index of Refraction		
2	32.2	10	42.1	40.8	20
2	32.2	8	42.1	39.6	25
3	32.2	7	42.1	38.6	43
4	32.2	6	42.1	37.1	67
5	32.2	5	42.1	36.0	100
6	32.2	4	42.1	33.2	133
2	34.3	10	42.6	40.9	20
2	34.3	8	42.6	39.8	25
2	34.3	10	42.1	40.6	20
2	34.3	9	42.1	40.4	22
2	34.3	8	42.1	39.8	25
2	34.3	8	42.1	40.2	25
2	33.0	8	42.1	40.5	25
1	33.0	9	42.8	41.8	11
2	33.9	8	42.8	40.5	25
3	33.9	7	42.8	39.9	42
4	33.9	6	42.8	38.6	66
5	33.9	5	42.8	36.9	100
1	33.9	9	43.4	41.6	11
2	33.9	8	43.4	40.8	25
3	33.9	7	43.4	39.9	42

TABLE 9.—*The Effect of Addition of Water on the Index of Refraction of Breast Milk Serum (tests by standard method)*

Water Index of Refraction, 14.5	Breast Milk	Inital Index of Refraction	Index of Refraction of Mixture	Percentage Adulteration
1 c.c.	9 c.c.	43.9	41.1	11
1 c.c.	9 c.c.	42.7	40.2	11
1 c.c.	9 c.c.	42.1	39.5	11
1 c.c.	9 c.c.	42.6	40.0	11
1 c.c.	9 c.c.	42.8	40.2	11
1 c.c.	9 c.c.	43.4	39.9	11
1 c.c.	9 c.c.	42.7	39.9	11
1 c.c.	9 c.c.	42.3	39.8	11
1 c.c.	9 c.c.	43.0	40.1	11
2 c.c.	8 c.c.	42.8	37.8	25
3 c.c.	7 c.c.	42.8	35.6	43
4 c.c.	6 c.c.	42.8	33.1	66
5 c.c.	5 c.c.	42.8	30.1	100
2 c.c.	8 c.c.	42.8	37.2	25
3 c.c.	7 c.c.	42.8	35.5	43
4 c.c.	6 c.c.	42.8	32.6	66
5 c.c.	5 c.c.	42.8	30.2	100

difference between the two kinds of serums is 7.6. The average difference is 9.3. Any sample of breast milk serum yielding a refractometer reading below 42.0 may well be suspected of adulteration.

The fore-milk, mid-milk and strippings in two samples, gave the results in Table 6.

Fifteen samples from mothers in the beginning of lactation (from six to fourteen days postpartum) gave the readings in Table 7.

The results seem to indicate that the index of refraction of breast milk of mothers in the early part of lactation does not differ significantly, if at all, from that of the serum of breast milk in the later period of lactation.

EFFECT OF ADDED WATER OR COWS' MILK ON THE INDEX OF REFRACTION OF BREAST MILK SERUM

To determine quantitatively the effect on the index of refraction of known adulteration, various mixtures of cows' milk and breast milk were tested by our method. The values are given in Table 8. From 20 to 25 per cent. of cows' milk can be detected with reasonable assurance. Table 9 shows that water added to breast milk lowers the index of refraction of its serum, and that an addition of 11 per cent., or more, water can be detected.

CONCLUSIONS

1. A method of determination of the index of refraction of breast milk serum is proposed.

2. By this method, the addition to breast milk of 11 per cent. of water and 20 per cent., or more, of cows' milk may be simply, rapidly and accurately detected.

THE BASAL METABOLISM AFTER PNEUMONIA*

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In a previous paper,[1] we pointed out that not infrequently after certain infections there is a lowered basal metabolism. We also found a low basal metabolism in two cases of meningitis. It was then emphasized that a bradycardia or a slow pulse might be a symptom of a low basal metabolism. This suggestion received corroboration even while our manuscript was in press, by the finding of a low basal metabolism in cases of brain tumor.[2] In other nervous diseases not characterized by a slow pulse, such as tabes, hemiplegia, cord tumors, etc., there was a normal basal metabolism. Similarly, we suggested the possibility of a low basal metabolism in cases of icterus with a slow pulse, which possibility has received support in a recent study.[3] Talbot, in a paper just published,[4] has shown once more the correlative relationship between pulse, temperature and basal metabolism.

In our present series, we limited ourselves to cases of pneumonia, which disease, because of its temperature curve, is well suited for a postinfectious metabolic study. It was decided to concentrate on the metabolic phase, and to omit studies of the size of the heart as a possible cause of the postpneumonic slow pulse, which, we have shown, is frequently accompanied by a low basal metabolism. As we expressed in our addendum, Dr. F. G. Benedict criticized us for not making our determinations in triplicate or at least in duplicate, though it was admitted that this would only serve to lower an already low metabolism. Nevertheless, we made triplicate metabolic determinations throughout this study except in trained children when the first two determinations agreed closely. This we could do, for we employed the Krogh apparatus which has a graphic method of registration of the respiration, which also permitted us to check up the cooperation of the patient. As a

* Received for publication, Dec. 7, 1925.

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1. Schick, Bela, and Cohen, Philip: Lowered Basal Metabolism in Postinfectious Stages and in Diseases Characterized by Slow Pulse Rate: Preliminary Report, Am. J. Dis. Child. **30**:291-309 (Sept.) 1925.

2. Guillain, G.; Laroche, G., and Alajouanine: Metabolism in Brain Tumors, Compt. rend. Soc. de biol. **92**:574 (March 7) 1925.

3. Helmreich, E.: Personal communication (Pirquet clinic).

4. Talbot, F. B.; Dalrymple, A. J., and Hendry, M. F.: Skin Temperature and Basal Metabolism During Fasting, Am. J. Dis. Child. **30**:491-495 (Oct.) 1925.

matter of fact, we discovered that three determinations by this method, or other methods of breathing through a mouthpiece, fatigued some children and made the third determination inaccurate. It was, therefore, disadvantageous in some cases to perform three basal metabolism determinations by this method, for a false average resulted.

LIMITATION OF SUBJECTS

Our work was limited to the children of our department who could cooperate with a method involving mouth breathing, which resolved itself to children of 5 to 6 years or over. The children were kept in bed during the entire period of metabolic study except for occasional respites. Their diet was practically the same throughout the study so far as total calories and the protein content were concerned, and it was sufficient to maintain a fairly constant weight curve. This was accomplished by giving a diet containing one-third more than the estimated basal metabolism. The basal metabolism was determined as soon as possible after the infection had subsided and at selected intervals thereafter, until we felt that a normal basal metabolism had been reached for that person. This individual standard we have always felt to be more satisfactory in children than comparison with averages or average curves. The basal metabolism of normal children or children without infections were similarly determined with the same frequency. The pulse of each patient was taken when the basal metabolism was being determined. The sitting height, and later the standing height, of each child was taken for academic and scientific purposes, as suggested by Dr. Benedict. Details of the experiment may be seen in the table.

It will be seen by scanning the data, that eight of twenty-one subjects had a basal metabolism rising from a low to a normal reading (Cases 3, 5, 8, 10, 11, 15, 16 and 20). Seven subjects showed little or no change in basal metabolism (Cases 2, 4, 6, 9, 18, 19 and 21). Three were somewhat irregular (Cases 7, 13 and 17), but probably belong to the ones with unchanging metabolism. Three metabolisms began with a high postinfectious reading (Cases 1, 12 and 14) which gradually declined to normal. In some of the patients in whom the metabolism rose from a postinfectious low level, the initial determinations were probably a little too high, due to the novelty of the task set the child (Cases 3, 8, 15 and 16). This soon corrected itself as the child entered in the spirit of his work and cooperated heartily. The pulse rate did not correlate with the level of metabolism so well as in our first series, but what was surprising was the general slowness of the pulse. A pulse rate of 60 or so was the ordinary, commonplace finding, and that too in children. This finding of such a slow pulse in most children is certainly contrary

Findings in Pneumonia Patients

Case Sex* Age	Weight, Kg.	Date	Pulse	Sitting Height, Cm.	Standing Height, Cm.	Total Calories	Cal. per Kg. of Body Weight	No. Days Post-crisis	Remarks
1	20.8	1/ 7/25	60	65	...	846.7	40.7	5	Extremely sick, started with signs and symptoms simulating encephalitis. Gained 2 kg. on 1,400 calories, equal to 64.2 calories per kg.
♂		1/10/25	60	..	...	846.4	40.7	8	
10 yr.		1/11/25	62	..	...	671.0	32.9	9	
	22.1	1/23/25	62	..	...	798.7	36.1	21	
	22.8	1/27/25	67	..	...	671.0	29.4	25	
2	22.1	2/10/25	68	68	128	845.7	38.2	3	Not very ill. Gained 0.8 kg. on 60 calories per kg.
♂		2/14/25	58						
8½ yr.		2/19/25	58						
		2/21/25	80						
		2/26/25	72						
		3/ 2/25	77						
3	23.5	2/12/25	64	67	...	800.0	34.0	1	Not very ill. Gained 1.25 kg. on 52 calories per kg.
♀		2/17/25	64	..	...	723.2	31.1	6	
8 yr.	24	2/21/25	76	..	...	907.0	37.8	10	
	24	2/26/25	75	..	...	906.5	37.7+	15	
	24.4	3/ 2/25	76	..	...	956.0	39.1	19	
4	21.2	2/17/25	90	64	...	767.8	36.2	4	Very ill. Wildly delirious, meningeal signs. Temperature subnormal after crisis. Gained 1.4 kg. on 51.5 calories per kg.
♂		2/19/25	90	..	...	833.8	39	6	
8 yr.	22.2	2/24/25	82	..	...	891.6	40.1	11	
	22.6	2/28/25	70	..	...	784.0	34.6	15	
5	21.1	2/21/25	84	65	...	825.0	39.1	7	Not very ill. Weight stationary
♂		2/24/25	94	..	...	861.0	40.8	10	
6 yr.		2/28/25	104	..	...	886.9	42.0	14	
		3/ 5/25	90	..	...	1003.0	47.5	21	
6	21.7	2/26/25	94	64	...	759.5	35	4	Uneventful case. Weight stationary
♂		2/28/25	84	..	...	759.5	35	6	
8 yr.		3/ 3/25	90	..	...	789.0	37.3	9	
7	19.7	3/ 3/25	60	63	...	808.0	41	3	Not very ill. Temperature subnormal. Gained 0.5 kg. on 53.5 calories per kg.
♂		3/ 9/25	70	..	...	666.4	33	9	
7½ yr.		3/12/25	70	..	...	761.9	38.7	12	
		3/17/25	76	..	...	808.0	41	17	
		3/18/25	60	..	...	705.6	35.8	18	
		3/23/25	60	..	...	793.8	40.3	23	
8	21.8	3/ 5/25	74	65	115	740.0	33.9	5	Very ill; meningeal and abdominal signs. Rapid recovery. Weight stationary on 51+ calories per kg.
♂		3/10/25	75	..	...	783.0	35.8	10	
7 yr.		3/12/25	60	..	...	634.9	28.6	12	
		3/17/25	80	..	...	624.0	28.1	17	
		2/23/25	88	..	...	646.8	29.5	23	
		3/25/25	80	..	...	768.0	35.3	25	
		3/26/25	88	..	...	760.0	34.8	26	
		3/27/25	92	..	...	754.2	34.5	27	
9	19.2	3/10/25	72	67	...	808.0	42.1	5	Never very ill. Weight stationary
♂		3/12/25	80	..	...	776.0	40.0	7	
7 yr.		3/17/25	80	..	...	891.0	46.4	12	
		3/18/25	72	..	...	833.0	43.3	13	
10	16.5	3/19/25	68	62	112	517.0	31.3	3	Temperature subnormal three days before first metabolism. Gained 1 kg. on 60 calories per kg.
♂		3/23/25	64	..	...	552.0	33.5	7	
6 yr.		3/25/25	70	..	...	631.0	38.2	9	
		3/27/25	..	..	...	536.0	29.9	11	
		3/30/25	..	..	...	881.8	53.4	14	
11	22	3/26/25	60	59	114	637.0	29	5	Gained 0.5 kg. on 1,180 calories, equal to 49 calories per kg. Not very ill here but had been very sick at home according to statements of family physician
♀		3/28/25	60	..	...	677.2	30.7	7	
7 yr.		3/30/25	60	..	...	943.9	42.9	9	
		4/ 2/25	60	..	...	788.0	35.8	12	
		4/ 4/25	60	..	...	766.0	35+	14	
		4/ 6/25	60	..	...	769.0	35+	16	
12	21.5	4/ 6/25	60	64	115	1009.0	46.5	6	Fairly ill. Gained almost 0.5 kg. on 63.5 calories per kg.
♂		4/ 7/25	60	..	...	955.0	44.0	7	
8 yr.		4/ 9/25	60	..	...	959.0	44.6	9	
		4/11/25	70	..	...	959.0	44.6	11	
		4/13/25	66	..	...	818.0	38+	13	
	21.8	4/15/25	60	..	...	874.8	40.6	15	
	21.8	3/17/25	60	..	...	877.0	41.0	17	
	22.2	4/20/25	68	..	...	705.0	31.7	20	

* In this column, ♀ indicates female; ♂, male.

Findings in Pneumonia Patients—Continued

Case Sex* Age	Weight, Kg.	Date	Pulse	Sitting Height, Cm.	Standing Height, Cm.	Total Calories	Cal. per Kg. of Body Weight	No. Days Post-crisis	Remarks
13	17.0	4/13/25	72	63	...	620.8	36.5	3	Temperature subnormal for 2 days preceding first metabolism. Gained 0.8 kg. on 62 calories per kg.
♂		4/15/25	70	..	...	818.4	48.1	5	
9 yr.		4/17/25	80	..	...	784.0	46.1	7	
		4/20/25	78	..	...	597.0	35.1	10	
		4/23/25	68	..	...	607.0	35.7	13	
		4/26/25	60	..	...	642.0	37.7	16	
	17.8	4/28/25	80	..	...	705.5	41.4	18	
14	24.5	4/15/25	64	70	130	1124.5	45.9	3	Fairly ill; subnormal for a day. Gained 1 kg. Diet increased on 4/27. Gained on 52 calories per kg.
♂		4/17/25	64	..	...	1058.0	43.1	5	
9 yr.		4/20/25	64	..	...	862.0	35.1	8	
	25.2	4/21/25	60	..	...	700.0	28.6	9	
	25.2	4/24/25	60	..	...	940.0	37.3	12	
	25.4	4/26/25	63	..	...	784.0	31.4	14	
		4/28/25	63	..	...	705.5	27.7	16	
15	15.8	4/20/25	56	56	103	600.0	38.0	3	Not very ill. Temperature subnormal for a few hours. Weight stationary
♂		4/21/25	76	..	..	626.0	39.6	4	
5 yr.		4/28/25	66	..	...	510.0	32.2	11	
		5/ 1/25	72	..	...	500.0	31.0	14	
		5/ 3/25	70	..	...	710.0	44.9	16	
		5/ 7/25	68	..	...	730.0	46.2	20	
		5/10/25	60	..	...	750.0	47.4	23	
16	22.8	4/26/25	72	65	122	793.8	34.8	5	
♂		4/28/25	56	..	...	705.5	30.9	7	
6 yr.		5/ 1/25	58	..	...	729.0	31.9	10	
		5/ 3/25	60	..	...	798.7	35.0	12	
		5/ 7/25	72	..	...	818.0	35.8	16	
		5/10/25	60	..	...	817.0	35.8	19	
17	19.2	5/20/25	64	65	112	818.0	42.6	4	Not very ill
♂		5/23/25	70	..	...	759.5	39.5	7	
6 yr.		5/25/25	66	..	...	624.0	32.5	9	
		5/28/25	60	..	...	805.0	41.9	12	
		6/ 1/25	62	..	...	798.7	41.5	14	
		6/12/25	60	..	...	906.5	47.2	25	
	20.2	6/16/25	80	..	...	705.6	34.9	29	
	20.2	6/18/25	..	..	...	888.9	44.0	31	
18	22.5	5/23/25	100	69	117	872.0	38.7	3	Uneventful course. Weight stationary
♂		5/25/25	81	..	...	798.0	35.4	5	
6 yr.	21.8	5/29/25	84	..	...	931.0	42.7	9	
	22.0	6/ 1/25	80	..	...	960.0	43.6	11	
19	18.9	6/12/25	80	60	113	764.0	40.4	9	Weight stationary on 1,000 calories equal to 52.9 calories per kg. Fairly sick case
♀		6/16/25	86	..	...	666.0	35.2	13	
5 yr.		6/18/25	92	..	...	761.9	40.3	15	
		6/22/25	100	..	...	747.8	34.2	19	
		6/27/25							
20	19.7	6/16/25	84	67	129	666.0	33.3	5	Not very ill. A chronic asthmatic patient. Weight stationary on 1,000 calories equal to 50.7 calories per kg.
♀		6/18/25	90	..	...	784.0	40.0	7	
8½ yr.	19.2	6/23/25	80	..	...	747.8	37.9	12	
		6/27/25							
21	13.6	6/16/25	84	63	...	735.0	54.0	4	Quite ill. Weight stationary on 1,000 calories equal to 73.5 calories per kg.
♀		6/18/25	80	..	...	622.0	45.7	6	
6 yr.		6/22/25	80	..	...	620.8	45+	10	
		6/27/25							

* In this column, ♀ indicates female; ♂, male.

to accepted teachings and texts,[5] and emphasizes the importance of the conditions under which a pulse rate is taken. In these subjects we had basal conditions and hence what might be termed a basal pulse rate. The low postinfectious basal metabolism lasts for about one to two weeks. In cases of persistent bradycardia, we have found [1] a low basal metabo-

5. Holt, L. E.: Diseases of Infancy and Childhood, Ed. 7, New York, D. Appleton & Company, pp. 576, 1919.

lism for the entire period of the bradycardia, for weeks in some cases. The high postinfectious basal metabolism persisted from two to three weeks. Our control cases showed little or no variation, corresponding to the group of postinfectious unchanging metabolism. These facts have been graphically presented in the charts. The control cases were reported recently in another metabolic study [6] and hence are not given in detail here.

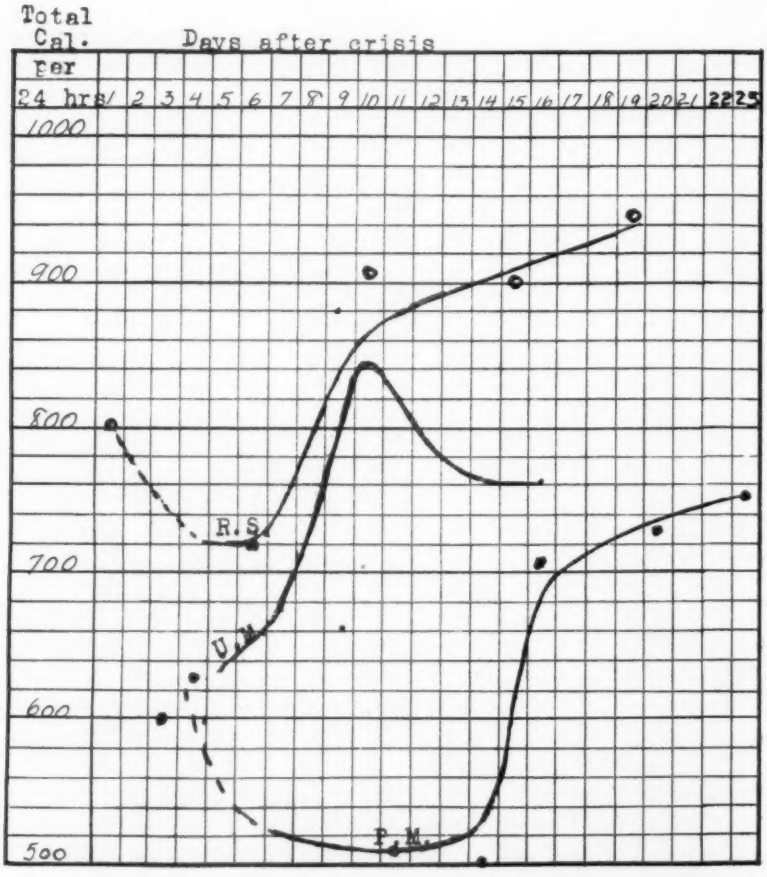

Chart 1.—Low postpneumonic basal metabolism rising to normal.

In our preliminary report,[1] we suggested a theory for the low postinfectious basal metabolism. In brief, this theory explains the low metabolism by depression of the function of the endocrine glands by the infection, as the pancreas in the infected diabetic patient, or the thyroid

6. Fries, M. E.: Influence of Ultraviolet Light on Basal Metabolism in Children, Proc. Soc. Exper. Biol. & Med. **22**:431 (May) 1925.

in the postscarlatinal patient. Linked with this we have a generalized cellular damage in an infection of the severity of pneumonia which does not permit a normal metabolism, as witness the fatty livers frequently found, which simply mean a lowered ability or inability to utilize the normally transported fat.[7] In the postinfectious, high basal metabolism, we have a stimulation of the endocrine glands, particularly of the thyroid, which persists during the postinfectious state. This is comparable to the hyperthermias which Finkelstein[8] described after scarlet fever, and

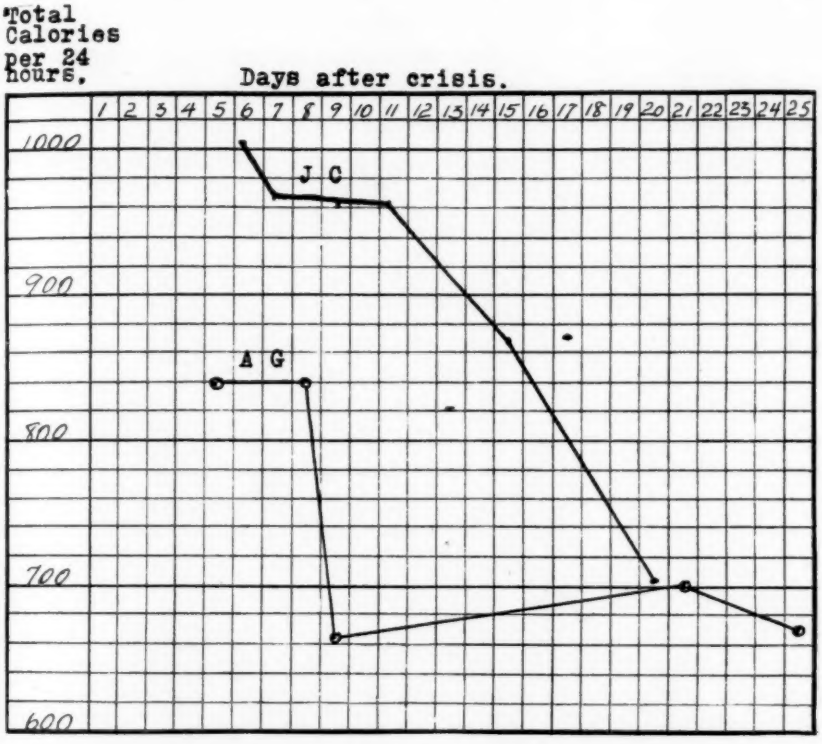

Chart 2.—High postpneumonic basal metabolism falling to normal.

which he could dissipate with an injection of epinephrin. In the patients with an unchanging postinfectious metabolism, the endocrine changes and the cellular injury were too small to effect metabolic aberrations. It is worthy of note that it is a clinical impression that the children with an unchanging postpneumonic basal metabolism were least prostrated after the pneumonia had subsided, with one or two exceptions.

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7. Aschoff, L.: Fatty Degeneration; from Lectures on Pathology, New York, Paul B. Hoeber, 1924.

8. Finkelstein, H.: Habitual Hyperthermia During Recovery from Scarlet Fever, J. A. M. A. **83**:611 (Aug. 23) 1924.

It is a frequent observation that after an infection, sometimes mild, usually severe, the increase in the child's weight may be beyond control. At other times we see a sudden cessation of the normal growth and normal accumulation of fat. In our study of postinfectious metabolism, we frequently noted that a child gained relatively much weight for such a short period. Might not the same factors that brought about the changed postinfectious basal metabolism be, in part, responsible or contributory to the postinfectious changed metabolism of those children?

SUMMARY

1. After pneumonia, there is not infrequently a low basal metabolism which rises to normal in from one to three weeks, occasionally longer, which is associated with a slow pulse rate.

2. Less frequently, we meet a high postinfectious basal metabolism which declines to normal in from two to three weeks.

3. Often after infections, there is a marked tendency to obesity or a leanness, or a stunting of the growth processes, which may be related to the findings mentioned in the foregoing.

TRYPSIN SECRETION OF INFANTS

WITH SPECIAL REFERENCE TO RICKETS *

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PANCREATIC INVESTIGATION

The function of the pancreas has been the subject of investigation by pediatricians on three occasions only. When it first was recognized that the physiology of an adult is not in every respect similar to that of the infant, and when Czerny's classical saying became widely known —"An infant is not a miniature adult," Zweifel, Jakubowitch,[1] Moro,[2] Ibrahim,[3] Hammarsten, etc., and later Hess,[4] made researches on the physiologic function of the infant's pancreas. We then became aware that the pancreas of the 6 month fetus contains active ferments, and that the pancreatic ferment production of the infant is greater than that of the adult.

At this time, nutritional disturbances were called "digestive disturbances." It was logical that after recognizing the physiologic function one should raise the question whether the so-called "digestive disturbances" are not caused by decrease of the digestive ferments. The investigations of Heubner,[5] Hess,[4] Lust [6] and Hahn [7] have proved the falsity of this supposition. There is only one disease which can truly be called a "digestive disturbance," namely, "infantilimus intestinalis" (Herter), which is really caused by the decreased formation of pancreatic ferments (Heubner [5]). This, however, is found only in children beyond the stage of infancy. Samelson [8] and later Beumer and Fontaine [9] also were not successful in their attempts to find a connection between the nutritional disturbances and the secretion of the pancreatic ferments. These negative results discouraged further investigations by pediatricians, yet these investigations have brought many interesting facts to light in spite of their negative results. They showed that in cases of alimentary intoxication the stools contain a reduced amount of pancreatic enzymes, while in those of decomposition a normal quantity is found.

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* Received for publication, Oct. 16, 1925.

* From the Pediatric Clinic; Director, Prof. E. Hainiss.

1. Jakubowitch: Jahrb. f. Kinderh. **47,** 1898.
2. Moro: Jahrb. f. Kinderh. **47,** 1898.
3. Ibrahim: Biochem. Ztschr. **24**:24, 1909.
4. Hess: Ergeb. d. inn. Med. u. Kinderh. **13**:565, 1914.
5. Heubner: Lehrb. d. Kinderh. **2**:440.
6. Lust: Monatschr. f. Kinderh. **11**:302, 1912.
7. Hahn and Lust: Monatschr. f. Kinderh. **11**:311, 1913.
8. Samelson: Ztschr. f. Kinderh. **4,** 1912.
9. Beumer, H., and Fontaine: Monatschr. f. Kinderh. **19**:524 (March) 1921.

The recent intensive investigation of rickets has attracted interest to the pancreatic function. In 1914, McClure and Chancellor [10] noted that the urine of children suffering from florid rickets contained far more amylase than that of normal children. This, confirmed by the investigations of Dodds,[11] Adam,[12], Hensch and Kramar,[13] and Ambrus,[14] became of diagnostic aid. Hizume [15] found also that the lipase of the stool during rickets increases. Trypsin had not yet been studied.

TRYPSIN EXAMINATION

We wished to fill this gap by examining the trypsin of the stool during rickets. To this end, it was necessary to have comparative data from both healthy and sick children of different ages. We, therefore, examined the physiology and pathology of the trypsin secretion during infancy under all possible circumstances. This was all the more necessary because the former methods of investigation of enzymes were not so satisfactory as those of the present day, and gave only qualitative results.

Altogether, we have examined 231 subjects. We employed the method of Gross-Fuld, but with some variations; the time of digestion was lengthened to twenty-four hours; as a preservative a combination of chloroform and toluene was used, and as a trypsin unit we chose that trypsin quantity which digests 10 c. c. of a 1 per cent. solution of Hammarsten's casein solution in twenty-four hours at 38 C. We added 1 per cent. sodium carbonate to the casein solution, and so stabilized the hydrogen ion concentration p_H 9.6, purposely overstepping the digestive optimum of the trypsin in order to suppress the effect of the non-separable trypsin. As a ferment number, we always took the trypsin units contained in 1 grain of feces.

We learned the following facts concerning nurslings and infants: The meconium feces of nursling contains a larger quantity of protease (from 60 to 80 units) than does the feces of older children and adults (from 10 to 30 units). After the meconium period, the amount of ferment drops to 20 or still lower, to rise again during the second to the fourth week to between 20 to 40, and after 3 months to 40 to 60. Nurslings fed at the breast generally show the higher quantities. Does trypsin alone cause this high value in the meconium, or are other ferments involved? It is indisputable that trypsin plays the leading rôle, because the digestive glands form secretions during the prenatal period

10. McClure and Chancellor: Ztschr. f. Kinderh. **11,** 1914.
11. Dodds, E. C.: Brit. M. J. **1**:511 (April 1) 1922.
12. Adam, A.: Klin. Wchnschr. **2**:1548 (Aug. 13) 1923.
13. Hensch, V., and Kramar, E.: Klin. Wchnschr. **2**:2205 (Nov. 26) 1923.
14. Ambrus: J. Orvosi Hetil., 1924, p. 431.
15. Hizume, K.: Jahrb. f. Kinderh. **106**:227 (July) 1924.

when there is still scarcely any resorption from the digestive canal, and when there is no excretion of feces. The meconium is made up chiefly of secretions of the digestive glands.

Our results agree with those of former investigators, Döblin,[16] Müller,[17] and Abelmann,[18] who found that the feces of infants contain a higher quantity of protease than those of adults. Continuing along these lines, we have supplemented the former results by recognizing the higher proteolytic power of meconium and the fact that the quantity of trypsin secretion varies with the age of the infant (Chart 1).

We have followed closely the variations of the trypsin secretion during the most varied diseases, not only in infants suffering from nutritional disturbances, but also in those with infectious diseases. We had special opportunity to examine patients with influenza.

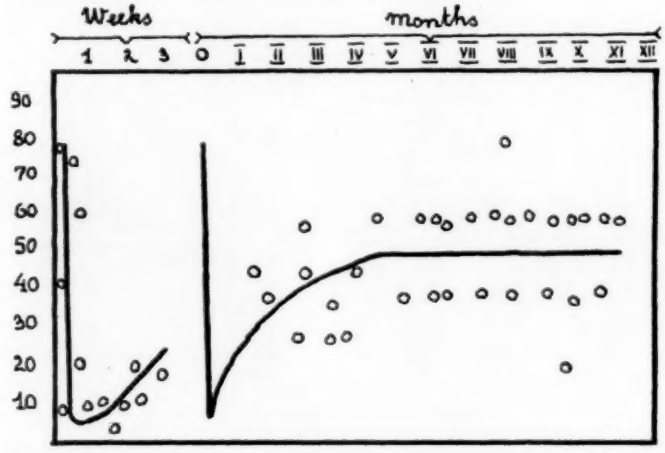

Chart 1.—Normal curve of trypsin excretion by the stool of healthy new-born and young infants.

In all cases of infectious disease, both of enteral and parenteral origin, the variations in the quantity of ferment are the same. It varies at the beginning and often even before the commencentment of the illness. During the illness itself, it decreases to a far lower quantity than that of a healthy child and remains at this low level during the whole illness. At the beginning of recovery, it again varies, and finally becomes normal. These results are similar to those found in cases of nutritional disturbances, such as dyspepsia and alimentary intoxication; a period of variation prior to the illness sometimes is followed by a period of variation during recovery. Similar conditions are encountered in other

16. Döblin: Deutsch. med. Wchnschr., 1909, p. 1095.
17. Müller: Deutsch. Arch. f. klin. Med. **92**, 1907.
18. Abelmann: Verhandl. d. ges. f. Kinderh., 1910.

infectious fevers (angina) of short duration. With decomposition, the degree of fermentation does not vary, except in serious forms, when, during the period before death, after a short variation in amount lasting from one to two days, the ferment disappears from the feces. This disappearance is not characteristic of decomposition but is also to be found just before death in patients with influenza and erysipelas (Chart 2).

We can, of course, estimate only with reservations the function of the pancreas from the quantity of the protease contained in the feces. The ferment found in the stool has passed through the whole intestine and has been subjected to the digestive and resorbent processes and to other damaging conditions, for example, to the reaction of the intestinal contents. It is also inadvisable to estimate the function of the glands from the secretion of the pancreas after death, as some have

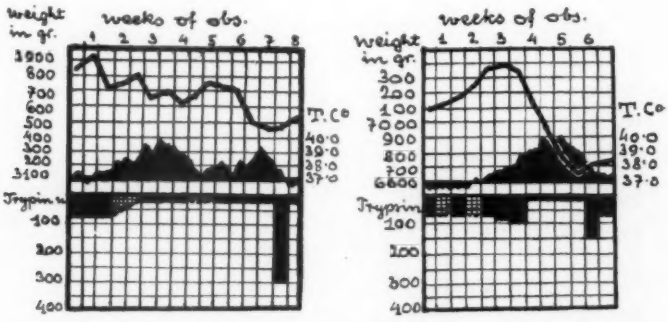

Chart 2.—Trypsin curves of infected infants without rickets.

done. We cannot conclude from the gland content that before death the ferment was secreted in similar quantities. It is probable that in cases of alimentary intoxication there is a hypofunction of the pancreas, because not only the trypsin but also the lipase and amylase of the feces are decreased, and in this condition there is sympatheticotonia (Heim [19]), and we know that the pancreas has an inhibitory effect on the sympathetic (Eppinger,[20] Loewy,[21] Wohlgemuth [22]) nerve.

The chief group was composed of children suffering from rickets. Altogether, we examined twenty-one babies ninety-eight times, among them some who had been under observation for five months.

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19. Heim: Read before the Annual Meeting of the Hungarian Pediatric Society, Budapest, May 19-20, 1925.

20. Eppinger: Wien. klin. Wchnschr., 1908.

21. Loewy: Arch. f. exper. Path. u. Pharmakol. **59**, 1908.

22. Wohlgemuth: Klin. Wchnschr., 1924, p. 1320.

RESULTS OF EXAMINATION

Children suffering from rickets alone from 160 to 600 units of trypsin in 1 grain of feces, that is, from four to ten times the normal amount. These figures change according to the child, but the figures for each child show only slight variations. It is not the most seriously ill child who has the greatest quantity of trypsin, but if the child recovers, the quantity of trypsin will be less, and if the condition becomes worse, the amount of trypsin will increase. The increase precedes a change for the worse.

If a child with rickets becomes infected, the amount of trypsin will decrease, just as in a child without rickets, but not to such a great extent. In children without rickets the degree of fermentation is generally under 20 and in rickets usually from 60 to 80. In serious cases accompanied by a fever of long duration, there can be a decrease to the minimum. During convalescence, it remains steadily above the former figure. The fermentation curve in patients with rickets is

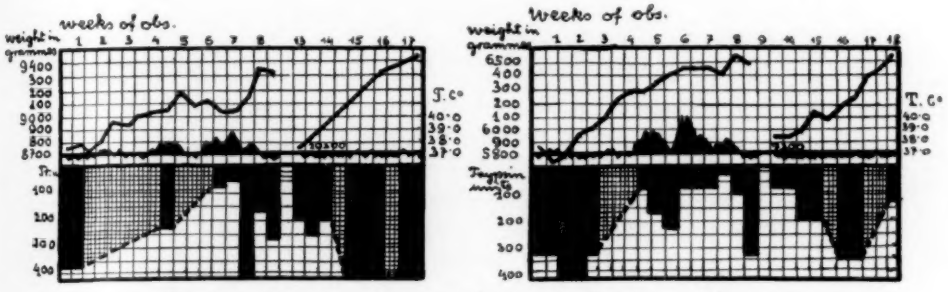

Chart 3.—Trypsin curves of infants suffering from rickets.

more irregular than in nonrachitic cases and the figures are always higher (Chart 3).

Consequently, it can be said that in cases of rickets there is a higher trypsin secretion from the pancreas. This fact may be significant in the diagnosis and pathology of rickets.

It is often difficult to decide whether a case of rickets is florid or not, because with the exception of prodromal symptoms, we had only the bony changes to guide us, which necessitates a great loss of time. A short time ago, it was discovered that children suffering from florid rickets have an increase of amylase and phosphate in the urine. Now, in addition to this, the results of our observations give us a third diagnostic point: Children having continuously more than 160 to 200 units of trypsin in 1 grain of feces are suffering from florid rickets.

Our results may be of importance in the pathology of rickets. It has been shown that in children suffering from rickets there is a higher secretion of amylase and lipase from the pancreas. We have now

shown the higher secretion of trypsin in such cases. We can, therefore, say that the entire external secretion of the pancreas is increased in rickets.

The symptoms of rickets are many and obscure. Not only the osseous system, but also the skin, the muscles, the hematopoietic organs, and the nervous system are affected, and the intermediary metabolism is also seriously involved. Regarding the increased trypsin secretion in rickets, the question can be asked whether there is a pathogenic connection between this increased secretion and some symptoms of rickets.

Trypsin is a protein compound which can be resorbed. If given parenterally, however, it is a deadly poison. Resorbed even by the digestive tract, it is not inoffensive, as is shown by the antitrypsin content of the blood. According to Oppenheimer,[23] the change in the quantity of the digestive ferments has a great influence on protein metabolism. When given either way, the picture of chronic protein poisoning may result. As the reticulo-endothelial organs destroy poisons, chronic protein poisoning may be a casual factor in anemia.

We will only mention the possibility of some pathogenic connections, supported by the following facts: Pentimalli [24] produced chronic protein poisoning and investigated the blood. He came to the conclusion that both cryptogenetic anemia and rickets result from chronic protein poisoning. Bosányi [25] found that the progress of rickets was associated with decrease of hemoglobin. Feuillié [26] injected protein in small quantities into young dogs over a long period of time. He found that the dogs developed a rachitic rosary. Freudenberg and György [27] found that the calcium absorption of the tissues of the body depends on the intermediary protein metabolism.

COMMENT

There seems to be a possibility of a pathogenic relationship between the increased trypsin secretion and some symptoms of rickets. Further research is being made along this line.

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23. Oppenheimer: Stoffwechselfermente, Braunschweig, 1915.
24. Pentimalli, F.: Klin. Wchnschr. **46**:2090, 1924.
25. Bosányi, A.: Wein. klin. Wchnschr. **38**:61 (Jan. 8) 1925.
26. Feuillié, E.: Compt. rend. Soc. de biol. **90**:62 (Jan. 25) 1924.
27. Freudenburg, E., and György, P.: Biochem. Ztschr., 142, 1923.

HEXYLRESORCINOL IN THE TREATMENT OF PYELITIS OF INFANCY AND OF CHILDHOOD*

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Because such measures as renal pelvic lavage cannot be employed in young children with the same facility as in adults, a more efficient internal urinary antiseptic, which could be administered by mouth without danger, would seem to be a particularly welcome addition to our present methods of treating the urinary infections of infancy and childhood. It was with great interest, therefore, that we undertook the clinical application of hexylresorcinol in this group of cases.

As has been pointed out,[1] hexylresorcinol [2] is the substance described as meeting all of the experimental qualifications enumerated by Davis and his co-workers [3] as essential to an internal urinary antiseptic. The experimental facts, on which its clinical employment is based, are as follows:

1. It is a stable chemical compound.
2. It is nontoxic in therapeutic doses.
3. It is nonirritating to the urinary tract.
4. It is bactericidal in high dilution in urine of any reaction.
5. It is eliminated by the kidney after administration by mouth, unchanged, in sufficient concentration to impart active bactericidal properties to the urine.

FORM OF ADMINISTRATION

Various forms of administration of the drug have been tried. Experimentally, normal men receiving hexylresorcinol, secrete bactericidal urine with a greater degree of expectancy, if the drug is dissolved in olive oil, than in any preparation tried. This is probably due to

* Received for publication, Oct. 27, 1925.

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1. Leonard, V.: Secretion of Bactericidal Urine and Disinfection of Urinary Tract Following Oral Administration of Certain Alkyl Derivatives of Resorcinol, J. A. M. A. **83**:2005 (Dec. 20) 1924; J. Urol. **12**:585 (Dec.) 1924.

2. The Preliminary Report of the Council on Pharmacy and Chemistry, J. A. M. A. **83**:2018 (Dec. 20) 1924.

3. Davis, E. G.: Urinary Antisepsis, J. A. M. A. **70**:581 (March 2) 1918. Davis, E. G., and White, E. C.: J. Urol. **2**:107 (April) 1918. Davis, E. G.; White, E. C., and Rosen, R.: J. Urol. **2**:277 (Aug.) 1918. Davis, E. G.: J. Urol. **2**:299 (Aug.) 1918; A. J. M. Sc. **161**:251 (Feb.) 1921.

prompt absorption from the small intestine.[4] The soluble gelatin capsule devised for adults and containing a 25 per cent. solution in olive oil, however, was found to be not quite suitable for children owing to its large size. More recently, a 2.5 per cent. solution of hexylresorcinol in olive oil has been employed. This appears to be the most convenient form of administration for children, can be given without any relation to feedings, is well borne and is apparently as efficacious as the more concentrated solutions.

Dosage.—A teaspoonful of the 2.5 per cent. solution contains 0.1 gm. It has been our custom to begin with doses of 0.1 gm. three times daily, increasing the dose gradually to 0.2 or 0.3 gm. three times daily, depending on the case. The first few doses may cause some catharsis, but this disappears within a day or two in spite of continued administration and increase in the dose.

As a rule, children tolerate relatively larger doses of hexylresorcinol than adults. We have given maximum doses, 0.6 gm. three times daily, to young children for weeks and even months at a time without the slightest evidence of any toxic action or any gastric or intestinal irritation. Just as in adults, however, a child will occasionally be found who cannot tolerate the larger doses. This is evidenced by diarrhea and by abdominal cramps, which disappear immediately when the drug is withdrawn or the dose reduced.

As in adults, there seems to be no objection to continuing the use of full doses of hexylresorcinol in children indefinitely. No toxic effects or irritant action on the kidney have ever been observed.

Management.—There can be little question as to the value of an increased fluid intake, and sometimes of the value of alkalis, in the treatment of the acute infections of the urinary tract in children. The value of these procedures in the management of the chronic infections may be open to serious question, but, however this may be, it should be borne in mind that both of these measures are contraindicated while the patient is receiving hexylresorcinol, for the reason that they raise the surface tension of the urine and thereby rob it of its bactericidal properties.[5]

Sodium bicarbonate with quantities of water may be administered in courses alternating with courses of hexylresorcinol, but the two methods of treatment should never be combined.

In the treatment of chronic *B. coli* infections of the urinary tract in adults, the majority of patients require from sixty to ninety days

4. Elliott, D. C., and Barbour, H. G.: Canad. M. A. J. **15**:787-788 (Aug.) 1925.

5. Leonard, V., and Frobisher, M.: J. Urol. (in press); Tr. Amer. Assoc. Genito-Urinary Surgeons (in press). Leonard, V., and Wood, A. H.: Hexylresorcinol as Urinary Disinfectant, J. A. M. A. **85**:1855 (Dec. 12) 1925.

continuous administration of hexylresorcinol for a permanent result.[6] While this length of time appears to be somewhat shorter, on the average, in children, it cannot be emphasized too strongly that satisfactory clinical result can be obtained in the majority of cases only through persistent treatment. The dose should be at least 0.2 gm. three or four times a day, and should be continued over a period of several weeks.

Henline [6] has emphasized the importance of establishing free urinary drainage, and of dealing appropriately with all discoverable foci of infection before attempting to disinfect the urinary tract. The question of free urinary drainage may not be so frequently a matter of vital importance in the chronic urinary infections of childhood as in adults, but more or less constant reinfection of the urinary tract from a distant focus is always a possibility in children, and should be ruled out as completely as possible in every case.

CLINICAL RESULTS

The following case reports include not only those patients under our personal observation, but a number of others reported to us by independent observers who have been cooperating in the work.

REPORT OF CASES

CASE 1.—B. L., a girl, aged 23 months, had had persistent pyuria, with almost daily elevation of temperature of 100 to 103 F. for six months, with loss of weight and anemia. She had been treated continuously during this period with alternate courses of sodium bicarbonate, sodium citrate and hexamethylenamin, together with forced fluids, with no benefit.

When first seen, there had been continuous elevation of temperature to 103 F. for three weeks. There had been an inguinal adnenitis which had about subsided. The urine was milky with pus, and cultures showed both *B. coli* and *Staphylococcus albus.*

Treatment was begun with 0.3 gm. of hexylresorcinol twice daily, and this dosage was continued throughout the entire course. Improvement in the general condition and in the appearance of the urine was immediate. By the sixth day the urine was practically clear macroscopically, and contained 800,000 *B. coli* per cubic centimeter, as compared with 200,000,000 per cubic centimeter in the specimen obtained before treatment. The staphylococci had disappeared and were not seen again. The child continued to gain rapidly. At the end of a month she was entirely free from symptoms, and the urine contained only an occasional leukocyte on low power magnification. Cultures continued to show *B. coli.*

At the end of the second month of treatment, no pus could be found in the urine. It was clear, but cultures continued to show a few *B. coli.*

Medication was continued for three weeks more, and two weeks later the urine was entirely free of pus and was sterile. Three months after discontinuing all treatment, the urine was microscopically normal and sterile. This child has continued in excellent health.

CASE 2.—C. L., a girl, aged 19 months, for two months had been having attacks of fever, associated with pyuria, with elevation of temperature to

6. Henline, R. B.: J. Urol. **14**:119 (Aug.) 1925.

104.6 F. The onset was sudden, with convulsions and a rise in temperature to 105.5 F. The attacks had since been coming on about once a week, and lasting from one to four days. There had been considerable loss of weight. During this period the child had been under the care of a number of competent pediatricians, and had received all of the usual treatment but had lost ground steadily. She was pale, apathetic and undernourished. The urine contained only a moderate quantity of pus and showed *B. coli* in pure culture.

Treatment was started with 0.3 gm. of hexylresorcinol twice daily, and this dosage was continued throughout the course.

Eight days after starting treatment, there was no change in the urine. She had an elevation of temperature to 103 F., lasting for three days. By the end of the second week some improvement in the general condition was evident, and the mother stated the child had not been so well since the onset of the trouble. On the twentieth day, there was fever, with a rise in temperature to 102 F. for one day. The general condition of the child continued to improve, but the urine showed no change.

By the end of the fifth week of treatment the child was apparently well, although the urine had not changed in the least and still showed a moderate quantity of pus and *B. coli* in pure culture. During the fourth and fifth week, there had been a very rapid and striking improvement in the appetite, color and weight.

Medication was continued for two weeks longer. There were no further febrile attacks after the twentieth day of treatment. Two weeks and again six weeks after discontinuing treatment, the urine was found to be free of pus, and sterile. This child continues in excellent health.

Both of these cases illustrate clearly the necessity for persistent treatment, and also the fact that under hexylresorcinol treatment there may be a pronounced improvement in the general health long before there is any marked improvement in the condition of the urine.

The next case illustrates the fact that a symptomatic cure may be obtained without any evidence of disinfection of the urinary tract, and that in some instances it appears to be impossible to obtain complete disinfection, even with the most persistent treatment.

CASE 3.—J. K., a girl, aged 2 years and 3 months, had had quantities of pus, and huge numbers of *B. coli* in the urine since an acute attack of pyelitis three months previously. The febrile attacks had continued for five weeks, the child being acutely ill during this period. She received hospital treatment for two weeks, the usual measures being employed without result. For eight weeks she had had only occasional moderate elevations of temperature about once a week, which usually only lasted for one day.

When first seen, the child appeared to be perfectly well except for slight undernourishment, anemia and the condition of the urine, which contained a large amount of pus and *B. coli* in pure culture.

Treatment with hexylresorcinol was started, and the dose was gradually increased to 0.3 gm. three times daily. This dosage was continued for four months, various forms of administration being employed. In spite of this long course of treatment, there was not the slightest effect on the urine. It continued to be turbid with pus, and always contained large numbers of *B. coli*. Within three weeks after starting the treatment, however, the child began to improve very markedly in weight and color, and all febrile attacks ceased. By the end of the second month she appeared to be in robust health, and has remained so since. Treatment was suspended after 130 days. At this time the urine was still turbid with pus, and contained numbers of *B. coli*.

The three following cases have been reported by Dr. Kenneth D. Blackfan. The first two illustrate the possibility of keeping the urine practically free of pus in certain instances, with very small doses of hexylresorcinol. The third case demonstrates the fact that the results of hexylresorcinol therapy cannot be expected to be very good if there has been such extensive damage of the kidney parenchyma as to interfere seriously with the kidney function.

CASE 4.—M. K., a girl, well developed and well nourished, aged 11 years and 8 months, was admitted to the hospital because of pain in the side. She had been treated at the Boston City Hospital one year previously for pyelitis. The temperature was elevated, but she was in good physical condition. The urine showed considerable pus and *B. coli* in pure culture. A roentgenogram of the kidneys was negative.

Treatment was begun with 0.15 gm. of hexylresorcinol three times daily, without any resulting gastric or intestinal disturbance. In the course of three weeks the urine gradually cleared, and the dosage was reduced to 0.15 gm. twice daily. This amount sufficed to keep the urine clear. The drug was discontinued after seven weeks.

CASE 5.—W. B., a boy, aged 11 years and 6 months, was brought to the hospital because of constipation of several years duration. He was pale and undernourished. Physical examination was negative, but the urine contained a large amount of pus and *B. coli* in pure culture. The kidney function was normal and roentgenograms were negative.

In addition to treatment instituted toward the relief of constipation, 0.15 gm. of hexylresorcinol was given three times a day. In one month the urine had cleared entirely, and the dosage was reduced to 0.15 gm. twice daily for the next two weeks.

After six weeks treatment, hexylresorcinol was discontinued. Four or five days later the patient noticed that the morning specimen again became cloudy but that the day specimens were clear. He is now receiving 0.15 gm. once a day, which this amount suffices to keep the urine almost free of pus.

CASE 6.—C. G., a boy, aged 8 years, was admitted to the hospital in the spring of 1924, in convulsions from uremia. There was a history of pyelitis from the age of 2 years. The urine contained quantities of pus and the roentgenogram showed stones in both kidneys. When the condition warranted, the boy was operated on; the stones were removed, first from one kidney, and later from the other. The kidney structure was found to be materially damaged. Both kidney pelves were dilated and there was marked pyelonephritis.

After recovery from the operation, the phenolsulphonphthalein output was only 10 per cent. in two hours and the urine continued to show large amounts of pus from both kidneys.

Although this type of case was not a favorable one, hexylresorcinol treatment was begun with 0.3 gm. twice daily. There was no toxic reaction in this child in spite of the low kidney function, nor any evidence of disturbance except a slight catharsis when the drug was first started. Although treatment was continued for three months, there was practically no change in the urinary findings.

The following case, observed by Dr. Frederick L. Gates of the Rockefeller Institute, is of special interest for the reason that it illustrates very strikingly the rôle which focal infection may play in these cases.

CASE 7.—B. G., a girl, aged 4 years, became acutely ill with fever and marked pyuria. The urine culture showed *B. coli* and a gram positive bacillus. After hexylresorcinol treatment was begun, the condition cleared up entirely in three days.

Ten days later, there was a recurrence of fever and pus again appeared in the urine. At this time a retroperitoneal mass was made out by rectal examination. This subsided without operation and "we have to fall back on the statistical probability that both the first infection and the recurrence were due to an appendiceal abscess. In the second instance, the urine cleared spontaneously with the subsidence of the primary focus."

It is possible that the focal infection described in the next case may have been indirectly responsible for the failure of the drug.

CASE 8.—A. Z., a girl, aged 9 months and 2 weeks, was admitted to the hospital because of fever, vomiting and diarrhea of three days duration.

Examination revealed marked pyuria with huge numbers of *B. coli* in the urine. Following six doses of 25 mg. of mercurochrome-220 soluble intravenously (4 mg. per kilogram of body weight), the temperature became approximately normal without any apparent improvement in the urinary condition.

On several occasions there were recurring attacks of otitis media with very high fever, the condition necessitating bilateral myringotomy.

Hexylresorcinol was begun eight days following the last dose of mercurochrome-220 soluble, and was rapidly increased to 0.4 gm. three times daily. This dosage has now been continued for fifty-four days without any apparent benefit. At the time of writing, there was just as much pus in the urine as before treatment, and cultures still showed a heavy growth of *B. coli.* In spite of very careful feeding there has been a loss of 1 pound (0.5 kg.) in weight. Treatment is continuing.

Occasionally, a child will be found who cannot tolerate hexylresorcinol and the drug has to be withdrawn on this account. While we have not personally observed this, two such cases have been reported to us, one by Dr. Charles H. Schroder of Duluth, and one by Dr. Rudolph Logefeil of Minneapolis.

On the whole, our experience has left us with the impression that, as a rule, children tolerate relatively larger doses of hexylresorcinol than adults, and that possibly on this account the course of treatment necessary to effect a complete and apparently permanent cure in chronic *B. coli* infections is usually somewhat shorter than in adults.

The two children whose cases are next described, received full adult doses of hexylresorcinol for many weeks without any evidence of gastric or intestinal irritation or other toxic effect. Both were cured.

CASE 9.—M. D., a girl, aged 2 years and 6 months, had been well until four weeks before admission to the hospital, at which time the mother had noticed that the child had fever, a tender abdomen and cloudy urine. During the next few weeks there was fever, loss of appetite and pain on urination.

On admission, examination was negative except for evident loss of weight and anemia. The urine contained quantities of pus and a pure culture of *B. coli.*

The treatment with hexylresorcinol was begun, and the dose was rapidly increased to 0.6 gm. three times daily. This (full adult dosage) was continued for forty-five days without any untoward effects.

During the first sixteen days of treatment, there were four short elevations of temperature but none subsequently. The pyuria began to diminish about this time. On the nineteenth day the urine was free of pus for the first time, but it was not until the twenty-eighth day after institution of hexylresorcinol therapy, that the urine was consistently free of pus and was sterile on culture.

Five months after discontinuing the drug, the urine was still normal. There had been a decided gain in weight, and the child appeared well in all respects.

CASE 10.—L. B., a girl, aged 6 years, became acutely ill with fever, chills, general malaise and marked pyuria, two weeks before coming to the dispensary. During the next two weeks she was treated from the dispensary by forcing fluids and large doses of sodium bicarbonate. As there had been no improvement, she was then admitted to the hospital.

The urine showed quantities of pus and a pure culture of an organism of the colon group, similar to *B. paratyphosus* in its fermentative reactions, but atypical in its agglutinations.

Hexylresorcinol was started, and by the sixth day the dose had been increased to 0.6 gm. three times daily. This dosage, which is usually considered to be the full adult dose, was continued for the next two months without the slightest evidence of any untoward effect.

After beginning the hexylresorcinol, there were no further elevations of temperature. Although there was a prompt and striking symptomatic improvement with a gain in weight of 3 pounds (1.4 kg.), the urine continued to show pus for several weeks. The pus then diminished and disappeared entirely before the first negative urine culture was obtained.

The patient was discharged one week after the first negative culture; she was seen three weeks later when she was found to be perfectly well and the urine was free of pus and sterile.

It has been our custom to continue the administration of hexylresorcinol for a minimum of two weeks, following the first negative urine culture. Case 11 may be interpreted as indicating that the drug should perhaps be continued for even a longer period after the urine becomes negative.

CASE 11.—E. L., a girl, aged 7 years, was admitted to the hospital five days following the onset of acute pneumonia. Four days later the chest was clear and the temperature normal, but the urine contained pus, blood, and a pure culture of *B. coli.*

Treatment was begun with 0.3 gm. of hexylresorcinol, increasing in two days to 0.45 gm. three times daily. There was a steady improvement in the urinary findings until the child was discharged, fifteen days later, when the urine was free of pus and blood, and was negative on culture. There was a gain in weight of over 2 pounds during this time.

The patient continued to take 0.45 gm. of hexylresorcinol for one month following discharge. Two weeks after discontinuing treatment, pus reappeared in the urine, and large doses of sodium bicarbonate were given for five days without result.

Hexylresorcinol was again started and the pus promptly disappeared. One month after discontinuing the second course of hexylresorcinol, the child continued well and the urine was found to be normal in all respects.

Dr. Henry F. Helmholtz, of the Mayo Clinic, has reported a case of chronic pyelitis due to *B. coli* in a child, who received hexylresorcinol treatment for eight days without apparent benefit. Large doses of hexamethylenamin then resulted in complete disinfection in four days.

In the following case, 6 doses of mercurochrome-220 soluble intravenously (4 mg. per kilogram of body weight) were given without any noticeable result, and prompt cure then followed the use of hexylresorcinol. It would appear that a sudden change of treatment from one drug to another may sometimes be followed by prompter results than could probably have been obtained with either one alone. The question of drug fastness in its application to the treatment of urinary infections plainly requires further study.

CASE 12.—M. C., a girl, aged 5 months, 2 weeks, was admitted to the Harriet Lane Home, nine days after the onset of an acute febrile illness. Other than abdominal tenderness, physical examination was negative. The urine showed quantities of pus and *B. coli* in pure culture.

On the day following admission, the temperature rose to 105 F. The child was given 28 mg. of mercurochrome-220 soluble intravenously (4 mg. per kilogram of body weight) without result. This dose was repeated five times during the next ten days. On discharge, twelve days after admission, the temperature was normal but the urine was still loaded with pus and *B. coli* in pure culture. There had been a loss in weight of 1 pound, 2 ounces, during this period.

Five days later the child was readmitted with a temperature of 102.4 F., the urine being stilled loaded with pus. Hexylresorcinol in doses of 0.2 gm. was started, which was rapidly increased to 0.4 gm. three times daily. Within twenty-four hours, the temperature was normal and remained so. The appetite improved rapidly and the child became alert and playful. On the fourteenth day after hexylresorcinol was started, the urine was found to be free of pus and sterile on culture. There had also been a decided gain in weight during this period.

Two months after discharge, this child was still in good health and the urine was still free from pus and sterile on culture.

The question has frequently come up as to whether or not hexylresorcinol treatment should be considered as contraindicated in nephritis. The drug has been administered in full doses to a number of adults suffering with chronic nephritis, complicated by urinary infection. In none of these has there been the slightest evidence of harm, while in some there has been very definite benefit, as evidenced by improvement in the general health and decrease or disappearance of edema, albuminuria and pyuria. In all of these the usual management was instituted as well, so that it is somewhat difficult to estimate the exact effect of the drug.

The following case, observed by Dr. William W. Anderson, should probably be interpreted merely as indicating that at least hexylresorcinol is not contraindicated in children suffering from nephritis.

CASE 13.—C. H., a boy, age 3 years, suffering from a severe chronic nephritis, had improved somewhat following the removal of the tonsils. There was generalized anasarca and the urine contained pus, casts, and large quantities of albumin. The renal function was 55 per cent. in two hours. The child had been kept in bed on a milk diet, and had been given Epsom salts and colon

irrigations for some time previous to starting treatment with hexylresorcinol. The same measures were continued during treatment with the drug.

After starting hexylresorcinol "the albumin gradually decreased in four weeks from solid on boiling to 2 or 3 gm. per liter, while the anasarca and edema entirely disappeared."

CONCLUSIONS

On the basis of our clinical experience with hexylresorcinol in the treatment of pyelitis in children, we believe that it is at times a distinct addition to the therapeutic measures heretofore at our command.

The striking improvement in the general health and nutrition, frequently observed in children taking hexylresorcinol, does not seem to be entirely dependent on the control of the urinary infection, for it may occur long before there is any noticeable improvement in the local condition and is sometimes the most impressive effect of the treatment.

To obtain the best results, treatment should be persistent, the fluid intake should not be increased, and soda should be avoided during administration of the drug.

POLYARTHRITIS. REPORT OF A CASE IN AN INFANT SIX DAYS OLD

ASSOCIATED WITH ACUTE RHEUMATIC FEVER IN THE MOTHER *

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AND

W. H. GRIFFITH, M.D.

MINNEAPOLIS

Nonsuppurative arthritis similar to acute rheumatic fever in adults is rarely found in children under 1 year of age.[1] Miller [2] reported twenty authentic cases, one of his own and nineteen from the literature up to 1899. He differentiated rheumatic fever as an acute migratory polyarthritis, nonsuppurative in type. Since 1899, single cases have been reported. Del Arca,[3] Griffith,[4] and Strømme [5] include three cases in their descriptions, the children ranging in age from 6 to 8 months. In the majority of cases reported, recovery took place in from several weeks to several months.

The etiology of the disease is not clear, though in a few cases the arthritis occurred in the infant soon after birth, following acute rheumatic fever in the mother during the latter part of pregnancy. This sequence of the disease in the mother and child is exceedingly rare.[6] Pocock [7] in 1882, and Schaefer [8] in 1886, each described a case in which

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* Received for publication, Oct. 19, 1925.

* Read before the Northwestern Pediatric Society, Minneapolis, Oct. 2, 1925.

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1. Feer, E.: Textbook of Pediatrics, Translated by J. P. Sedgwick and C. A. Scherer, Philadelphia, J. B. Lippincott Co., 1922, p. 706. Griffith, J. P. C.: The Diseases of Infants and Children, Philadelphia, W. B. Saunders Company, 1919. Birk, W.: Guide to the Diseases of Infancy, Translated by F. W. Schlutz, New York, Rebman Co., 1916, p. 267. Rotch, T. M.: Pediatrics, Ed. 5, 1906, p. 513. Cheadle: Keating's Cyclopedia of Diseases of Children, **1**:792, 1889. Senator: Ziemmsen's Cyclopedia of the Practice of Medicine **16**:17-18, 1877.

2. Miller, D. J. M.: Acute Articular Rheumatism in Infants Under One Year, with Report of a Case, Arch. Pediat. **16**:686-696, 1899.

3. Del Arca, E. E.: Rheumatismo Infantil, Rev. Soc. méd. arg. **11**:47-49, 1903.

4. Griffith, J. P. C.: A Case of Articular Rheumatism in an Infant, Arch. Pediat. **25**:265-266, 1908.

5. Strømme, J. I.: Acute Rheumatism of Infants, Tidsskr. f. d. norske Lægefor. **28**:585-588, 1908.

6. Langwill, H. G.: A Case of Rheumatic Hyperpyrexia During Pregnancy, Recovery with Subsequent Birth of a Living Child, Edinburgh Hosp. Rep. **6**:124-129, 1900. Heffernan, E. B.: Rheumatic Fever Complicating Advanced Pregnancy, M. J. Australia **1**:608 (June 3) 1922.

7. Pocock, F. E.: Case of Acute Rheumatism Occuring in a Newly Born Infant, Lancet **2**:804, 1882.

8. Schaefer: Ein Fall von acuten Gelenkrheumatismus bei einer Mutter und deren Neugeborenem Kinde, Berl. Klin. Wchnschr. **23**:79, 1886.

the mother had acute rheumatic fever in the week preceding delivery. The onset of the arthritis in the infants was at the age of 12 hours and 3 days, respectively, and both babies made a good recovery in three weeks. Strümpell [9] and Abrahams [10] described a similar sequence of joint involvement in the mother and infant, but the infants developed the purulent type of arthritis following acute rheumatic fever in the mother. These authors were of the opinion that the disease in the cases cited was transmitted intra-utero from the mother to the child. The case to be reported is similar to those of Pocock and Schaefer, but an attempt was made further to determine the etiology by certain bacteriologic examinations.

REPORT OF CASE

Mrs. R. H., aged 18, white, a primipara, was admitted to the University Hospital, Oct. 6, 1924, and was delivered by mid-forceps of a normal male infant on October 10. The pregnancy was complicated by a persistent cough, expectoration, rhinitis and sore throat beginning about one month antepartum. The patient was in bed for two weeks with severe headaches, chills and night sweats. With improvement of these symptoms on the fifth day before delivery, aching and pain on movement of both shoulder joints were noted. On admission to the hospital the following day, the left shoulder joint was tender on palpation, and movement of the left arm caused extreme pain. The right shoulder gave no evidence of involvement at this time. The temperature ranged from 99 to 102.8 F. during the first twenty-four hours. The chief complaint on entrance to the hospital was a sore throat and pain in the left shoulder. Roentgenograms showed a few diffuse fibroid deposits at the apex of the right lung, and no evidence of pathologic changes in the left shoulder girdle. On the third day postpartum, the left shoulder joint was much improved and the left knee joint became quite painful and swollen. The temperature rose to 102 F. each day for the first ten days postpartum, after which it became normal and the joint involvement gave less difficulty. Some stiffness of the joints was noted for about a month. The heart showed no definite signs, except a soft systolic murmur at the apex. The patient was discharged on the twentieth day postpartum in good condition, with the exception of slight pain in the affected joints on movement. She continued to bring in her breast milk, which was expressed manually, each day, and she nursed her baby at each visit to the hospital.

The baby was apparently well for the first five days. On the sixth day the temperature, which had been quite constantly about 98.6 F. by rectum, rose to 99.6 F. The right knee and right elbow joints were red and swollen and the child cried on movement of these joints. The following day there was considerable limitation of movement. Roentgenograms of the joints at this time, as well as later (fiftieth day of age), were negative. The temperature on the seventh, eighth and ninth day showed slight excursions from 98.6 in the morning to 100.4 F. in the afternoon. At no time while in the hospital did the temperature rise higher than 100.6 F. On the twelfth day, redness and swelling were noted over the right trochanter of the femur. On the thirteenth day, definite fluctuation was noted in the right knee joint, and 5 c.c. of thick, stringy mucoid material, of a slightly yellow color, was removed by needle for examination and culture. At the same time 50 c.c. of blood was obtained from the arm vein of the mother.[11] Microscopic examination of a smear of the joint

9. Strümpell: Textbook of Medicine, Ed. 4, **2**:2, 1912.

10. Abrahams, R.: Rheumatismus Neonatorum, M. Rec. **50**:547-550.

11. Clawson, B. J.: An Analysis of Two Hundred and Twenty Cases of Endocarditis, Arch. Int. Med. **33**:157-184 (Feb.) 1924.

fluid showed mucoid material with only a few pus cells and a few isolated cocci. Cultures of the mother's blood and the joint fluid of the baby yielded *Streptococcus viridans* in pure culture.[12] The organisms from both sources were similar, and were agglutinated by the mother's blood in a dilution of 1:50. The blood picture of the infant showed a hemoglobin of 83 per cent., 4,800,000 red blood cells and 14,600 white cells; 52 per cent. polymorphonuclears and 48 per cent. lymphocytes. Other laboratory examinations—blood Wassermann reactions of the mother and the child, Pirquet tuberculin test, and urine examination of the child—were negative. On the fifteenth day, the child was fastened to a small Bradford frame by a wide band around the abdomen and chest. The right lower extremity was flexed at the thigh, and the lower leg was extended at the knee by the aid of a pully and attached weights (from 200 to 300 gm.). The child was kept on the frame practically continuously for twenty-six days (to the age of 41 days). During this time, the child was nursed satisfactorily by placing him and the frame on the edge of a table, with the mother sitting beside the table. Some difficulty was experienced in keeping the child warm, but this was arranged by placing him in a basket for premature infants. The child was discharged in apparently good condition, with good function of the elbow joint but with slight flexion of the leg at the knee joint. The weight on discharge, at the age of 56 days, was 4,140 gm., a gain of 1,300 gm., or almost 3 pounds, over the birth weight. At no time were there any signs or symptoms of skin or mucous membrane involvement in the baby, and the heart was normal throughout. At the time of writing, the child was 8 months of age and was able to sustain his weight on both legs. There was no deformity or limitation of motion of the knee, elbow or hip joints.

CONCLUSIONS

In the case reported here, the sequence of the appearance of the disease, first, in the mother and then in the child, the exclusion of chronic and secondary arthritis by clinical and laboratory methods, the presence of a similar *Streptococcus viridans* in the mothers blood and baby's joint fluid, and the absence of local signs indicating a portal of entry after contact or other infection, point toward an intra-uterine infection of the infant through the placenta by the organisms circulating in the mother's blood.

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12. Clawson, B. J., and Bell, E. T.: A Comparison of Acute Rheumatic Fever and Subacute Bacterial Endocarditis, Arch. Int. Med. **37**:66 (Jan.) 1926

CONGENITALLY ACQUIRED PYELITIS *

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In reviewing the literature on pyelitis in the new-born, I found little information on the subject.

The first case report was made by Kovalesky and Moro [1] in which they report two cases, the youngest patient, aged 8 days, died on the eleventh day of *Bacillus coli* septicemia; Smith [2] reports two patients under 2 weeks of age; Helmholz [3] reported three cases, and says that at that time he found only one report in the literature, that of Kovalesky and Moro; later he reports an additional case in Abt's *Pediatrics*.[4] In this article he states "Pyelitis of the new-born is worthy of special mention because it is more common than is supposed and has received little attention in the textbooks. It is overlooked at this time, as in later years, because urinalyses are not performed. An unexplained fever occurring in the first two weeks of life may be due to pyelitis." Runge [5] and Finkelstein [6] also report cases. This year, two reports have appeared, one by Sauer [7] and one by Graham.[8]

As can be seen from the foregoing, little information has appeared regarding this disease in the new-born; from its early appearance I feel there is a probability that it may be congenitally acquired.

REPORT OF CASES

CASE 1.—H. P., a girl, was born April 10, 1921. She appeared normal until twenty-four hours after birth when she had a convulsion. She did not void until fifty-two hours after birth, and then only in very small quantities until the ninth day, when she voided freely for a twenty-four hour period. This was followed by a forty-eight hour period with scanty output. After this the infant voided normally. Convulsions continued from the second to the ninth day; during the twenty-four hour period she had a good output with only slight convulsions. During the next forty-eight hours there was scanty output with return of severe convulsions; these stopped after the urinary output was normal,

* Received for publication, Dec. 1, 1925.

1. Kovalesky and Moro: Zwei Fälle von Koliseptikame bei Neugebornen, Klin.-therap., 1901, No. 50.
2. Smith, Richard M.: Pyelitis in Infancy, M. Clin. N. Am. **1**:1165, 1918.
3. Helmholz, H. F.: Pyelitis in the New-Born, M. Clin. N. Am. **1**:1451, 1918.
4. Helmholz, H. F.: Abt's Pediatrics **4**:923, 1924.
5. Runge, H.: Pyelitis in New-Born, Zentralbl. f. Gynäk. **47**:319-321 (Feb. 24) 1923.
6. Finkelstein, H.: Lehrbuch. d. Sanglingskrankheiten, Ed. 3, Berlin, Julius Springer, 1924, p. 779.
7. Sauer, L. W.: Neonatal Pyelitis, J. A. M. A. **85**:327 (Aug. 1) 1925.
8. Graham, R. H.: A Report of Six Cases of Pyelitis in the Newly-Born Infant, Am. J. M. Sc. **170**:401 (Sept.) 1925.

and a catheterized specimen on the fifth day showed albumin, numerous pus cells, and a moderate number of hyaline and granular casts. The temperature ranged from 99 to 102 F. for the first ten days. The baby was given plenty of fluids and 5 grains of sodium citrate every three hours. She completely recovered in six weeks.

CASE 2.—H., a girl, was born Feb. 11, 1925. She showed no untoward symptoms except that she did not nurse well until the third day, when she developed a temperature of 105 F., which returned to normal on the eighth day. She had mild convulsions only from the third to the sixth day. A catheterized specimen of urine on the eleventh day showed albumin, a large number of pus cells both free and clumped, and many motile bacteria. Culture showed pure colon bacillus. Five days later, hyaline casts appeared in the urine. The infant was given 5 grains of sodium citrate, and 5 grains of sodium bicarbonate every three hours. She completely recovered at the end of five weeks.

CASE 3.—F., a girl, was born Sept. 9, 1925. She voided only once from the second to the fourth day. She showed pallor and anxious facies. She vomited occasionally and had a temperature ranging from 99 to 100.8 F. On the fourth day, a catheterized specimen of urine showed albumin, pus, a few hyaline casts and epithelial cells. A culture showed a pure colon bacillus infection. She was given large amounts of fluid and 5 grains of sodium citrate every four hours. She left the hospital at the end of ten days very much improved.

COMMENT

This group of cases differs from other reports on pyelitis in infants under 2 weeks of age, in that most cases reported were boys, whereas the cases in this group were all girls.

In two of the infants, Cases 1 and 2, the mothers had had pyelitis during pregnancy. In Case 2, the mother had such severe pyelitis that it was necessary to have her in the hospital for treatment during the fifth month of pregnancy. Two of the infants had convulsions, which were quite severe in one. Two of the patients recovered, and one was much improved when last seen.

Abstracts from Current Literature

Anatomy and Physiology

THE METABOLISM OF GALACTOSE. II. BLOOD SUGAR CURVES. ALLAN WINTER ROWE and JOSEPH CHANDLER, Endocrinology **8**:803, 1924.

This paper deals with the effects on blood sugar levels produced by feeding doses of galactose under carefully controlled conditions. The authors give the following summary:

1. The velocity coefficient of reduction by galactose is appreciably less than that of reduction methods, and dealing with mixtures of the two, give apparent values that are less than the truth.

2. Test meals of urea, with observations of blood levels and urine eliminations, show that delayed absorption apparently plays little or no part in cases showing increase in the so-called tolerance threshold.

3. Rapidity of elimination of urea is not conditioned solely by blood urea level, and the inference is drawn that determinations of blood and urine urea are measurements of related but not wholly dependent phenomena.

4. No blood sugar curve determined by straight line interpolation between isolated points gives more than a first approximation of the progressive change of blood sugar levels, and in many cases is definitely misleading.

5. The observed degree of hyperglycemia and of melituria show a complete lack of relationship. They are to be regarded as two parallel phenomena having a potentially common origin but being quantitatively mutually independent.

6. A general relationship between the type of curve and the magnitude of the exciting dose in connection with the so-called tolerance threshhold has been observed.

7. The anomaly of an inverse relationship of size of exciting dose to the magnitude of the observed hyperglycemia has also been recorded in certain cases.

8. Certain criteria for the administration of carbohydrate test meals have been defined, and emphasis is laid on the necessity of many equivalent doses when several sugars are to be compared.

9. The tissue absorption concept of Folin and Berglund has been discussed, and certain observations on the potential influence of the mammary gland on carbohydrate utilization adduced in its support.

ROYSTER, University, Va.

THE PHYSIOLOGICAL RESPONSE OF THE CIRCULATORY SYSTEM TO EXPERIMENTAL ALTERATIONS. I. THE EFFECT OF INTRACARDIAC FISTULAE. EMILE HOLMAN and CLAUDE S. BECK, J. Exper. Med. **42**:661, 1925.

An opening was made in the interventricular septum in dogs under ether anesthesia with the following results:

1. Death within twelve to thirty-six hours, when the defect was larger than 30 mm., in circumference in a heart of 120 to 140 Gm.

2. The resulting thrill and bruit were (*a*) directly proportional to the size of the opening, and, therefore to the volume flow of blood through it; (*b*) in

the exposed heart limited to the right ventricle, and in the surviving animal most pronounced over the right side of the chest; (*c*) were limited to systole.

3. With the larger defects there was a slowly progressive dilatation of the chambers of the heart and the vessels through which the shortcircuited blood passed; namely, left ventricle, right ventricle, the pulmonary artery and the left auricle. The right auricle and aorta were unchanged or smaller than usual, conforming in size to the relatively decreased volume flow through them. The enlargement of the heart was shown by roentgen ray and at necropsy.

4. A definite hypertrophy of heart, shown by increased weight, and thickening of the right ventricular wall, interpreted as being a physiologic response to increased effort necessary to propel forward an increased volume of blood.

5. A relative preponderance of the right ventricle shown by electrocardiographic studies.

6. With large defects in the septum a considerable increase of total blood volume, with a moderate defect a moderate increase, and with a small defect which healed completely, no increase.

7. A fall in general blood pressure commensurate with the volume of blood deflected into the shorter circuit. If the animal survives, a more normal blood pressure is established; (*a*) by an immediate increase of pulse rate; (*b*) a gradual increase in total blood mass. The pulse returns to a normal rate when the increase in blood volume becomes sufficient to cause complete compensation.

The authors give an interpretation of the sequence of events following the establishment of a septum defect, and state that these experiments present additional evidence to substantiate the hypothesis that the heart and blood vessels place themselves in harmony with the volume flow of blood through them; the former by dilatation and hypertrophy, the latter by dilatation.

THE PHYSIOLOGICAL RESPONSE OF THE CIRCULATORY SYSTEM TO EXPERIMENTAL ALTERATIONS. II. THE EFFECT OF VARIATIONS IN TOTAL BLOOD VOLUME. CLAUDE S. BECK and EMILE HOLMAN, J. Exper. Med. **42**:681, 1925.

Changes in blood volume were produced in dogs by massive blood letting and by intravenous introduction of large volumes of blood or sodium chlorid solution. The blood pressure was recorded and the size of the heart was determined by roentgenograms after each procedure.

The authors' conclusions in part are:

1. That the size of the heart conforms quite accurately to the volume of circulating blood.

2. That the addition of whole blood to the circulation of a normal dog increases the size of the heart, elevates the general blood pressure, and accelerates the pulse.

3. That massive blood letting reduces the size of the heart and lowers the general blood pressure to a degree commensurate with the volume of blood removed.

4. That the body has a remarkable blood volume reserve.

5. That massive plethora can produce an acute pulmonary edema with a transudation of blood through the pulmonary vessels. This is probably the result of over-distention of the pulmonary vessels.

From experiments in which the pericardium was incised after large infusions of blood, it is concluded that: The pericardium presents a limiting or constricting action to acute dilatation of the heart. The diastolic pressure tends to approach the systolic pressure in a circulatory system distended with blood. The limiting action of the pericardium may be responsible for the small differences in the size of the heart noted by Meek and Eyster in their studies on the effect of plethora.

Experiments were done to determine the effect on the heart of a redistribution of the normal blood volume. The following deductions are made:

1. Alterations in the peripheral circulatory bed, either by the inhalation of amyl nitrite, or by the intravenous injection of histamin, result in a marked reduction in the size of the heart, due, it is suggested, to a decrease in the volume of blood contained in the central circulatory bed, incident to a dilatation of the peripheral bed. The variations in heart size could not be attributed merely to the altered rate of cardiac contraction since there was no invariable interrelationship established.

2. Contraction of the peripheral vascular bed, either by the intravenous injection of epinephrin, or by an acute increase in the intracranial pressure, results in a demonstrable increase in the size of the heart, due, it is suggested, to an increase in the volume of blood contained in the central circulatory bed. Again, variations in the rate of cardiac contraction alone cannot be considered responsible for these variations in heart size.

3. The size of the heart is commensurate with the volume flow of blood throught it, whether the latter is altered by massive blood letting, by massive transfusions, or by a redistribution of the normal blood volume.

McCLURE, Evanston, Ill.

INVESTIGATIONS CONCERNING THE CHANGE OF GLYCOGEN OF THE LIVER INTO GLUCOSE IN VITRO. CHRISTEN LUNDSGAARD and SVEND AAGE HOLBØLL, Ugesk. f. Læger **41**:881, 1925.

Tables are shown to demonstrate hydrolysis of glycogen in freshly prepared, finely divided liver tissue in physiologic sodium chlorid solution at 37 C. and a p_H of 7.3 into α and β glucose. The addition of insulin to this liver preparation does not influence the hydrolysis qualitatively or quantitatively.

From these observations the authors attempt to explain the cause of the usual clinical observation, that is, the nocturnal rise of blood sugar. This rise results if insulin is absent from the blood, as there is then no factor inhibiting glycogenolysis, and further the α and β glucose coming from the liver glycogen is not converted into an oxidizable form of glucose.

INVESTIGATION CONCERNING THE ACTION OF LIVER TISSUE AND INSULIN UPON GLUCOSE IN VITRO. CHRISTEN LUNDSGAARD and SVEND AAGE HOLBØLL, Ugesk. f. Læger. **42**:905, 1925.

It was found that liver tissue in contrast to muscle tissue lacks the property of converting α and β glucose into new glucose, and from this finding it was concluded that the liver acts only as a storage depot for glycogen.

A schematic diagram is also presented to show the metabolism of glucose in the animal body.

SCHLUTZ, Minneapolis.

Pathology, Bacteriology and Biochemistry

THE TOXICITY OF HUMAN BLOOD PLASMA OBTAINED IN VARIOUS DISEASES. IV. STUDIES ON THE TOXICITY OF HUMAN BLOOD PLASMA FOR GUINEA-PIGS. SAMUEL A. LEVINSON, J. Immunol. **9**:463, 1924.

The author presents a few estimations of surface tension and the toxicity for guinea-pigs of the plasma taken from a few patients with various diseases. Control experiments, the sex and age of the patients, the time after the ingestion of food and water, etc., are not tabulated. However, the author feels warranted in concluding from two or three instances of any selected condition, that the toxicity of the plasma for guinea-pigs is increased in conditions associated with marked tissue destruction. Noting the few estimations of plasma fibrinogen which Gram made in various diseases, the author states that in those diseases showing a quantitative increase in fibrinogen the plasma is more toxic for guinea-pigs. No estimations of fibrinogen were made by the author on the plasmas which he found especially toxic. The relation of surface tension and toxicity in his tables is not evident. He states that death resulting from injection of plasma is due to intravenous coagulation.

OBSERVATIONS ON THE CROSS PROTECTIVE POWER OF ANTIPNEUMOCOCCUS MONOVALENT SERUMS, TYPES I, II AND III. B. S. KOLCHIN and LOUIS CROSS, J. Immuol. **9**:505, 1924.

Although the authors found that monovalent type Serums I and II showed some cross protection in mice, the titer was far below the protection titer against the homologus strains. Despite cross protection, agglutination was specific. Huntoon's polyvalent antibody solution gave no protection against any Group IV strains, although some of the rabbit monovalent serums did.

THE PRODUCTION OF PRECIPITINS FOR RAGWEED POLLEN. JULIA T. PARKER, J. Immunol. **9**:514, 1924.

Utilizing the fact that immune rabbits have a greater reactivity for heterologous antigen than normal rabbits, and by great care in the preparation of the ragweed antigens, Parker has demonstrated specific precipitins for ragweed pollens.

STUDIES IN SPECIFIC HYPERSENSITIVENESS. XI. THE FAMILIAL OCCURRENCE OF HAY-FEVER AND ASTHMA. W. C. SPAIN and ROBERT A. COOKE, J. Immunol. **9**:521, 1924.

Of 462 cases of hay-fever and asthma, the antecedent history was positive in 58.4 per cent. but in only 7 per cent. of normal persons. The incidence, in the general population, of hay-fever and asthma was found to be 3.5 per cent. The age of onset occurred in the first ten years of life in 89 per cent. of the patients with a bilateral antecedent history; in 31 per cent. of those with a unilateral family history, and in about 20 per cent. of those with a negative antecedent history. It is estimated that about 70 per cent. of children with a bilateral family history, will develop an atopic condition, and that about 50 per cent. of those with a unilateral family history will develop atopy. It, therefore, seems impossible that the inherited factor is a single recessive, as suggested by Adkinson. It might be either a single dominant or a multiple.

GUY, Peking.

QUANTITATIVE CHANGES IN BLOOD SUGAR AND IN BLOOD LACTIC ACID IN CANINE ANAPHYLAXIS. MARGERY MCCULLOUGH and FRANCIS O'NEILL, J. Infect. Dis. **37**:225 (Sept.) 1925.

Horse serum injected intravenously into normal dogs causes a gradual increase in the sugar content of the blood, the blood sugar rising to about twice the normal percentage by the end of two hours. This increase indicates a toxic action of horse serum on normal dogs, not shown by changes in arterial blood pressure, the currently used index in canine anaphylaxis.

Horse serum injected intravenously into "negatively sensitized" dogs causes no changes in blood sugar during the first two hours. These dogs, therefore, are resistant to the normal toxicity of horse serum, and should be regarded as immune.

During typical canine anaphylactic shock, the blood sugar increases rapidly, reaching nearly twice the normal concentration by the end of 20 minutes. The blood sugar then gradually decreases, being but slightly above normal by the end of two hours. After the first fifteen minutes, the curve thus obtained is identical with the blood sugar curve obtained by intravenous injection of an amount of glucose equivalent to the total estimated glycogen content of the liver.

During typical canine anaphylactic shock, the blood lactic acid increases to twice the normal concentration within the first thirty minutes, gradually falling to about 40 per cent. above normal by the end of two hours.

QUANTITATIVE CHANGES IN TISSUE GLYCOGEN, BLOOD SUGAR, PLASMA, INORGANIC PHOSPHATES AND IN BLOOD LACTIC ACID IN CANINE HISTAMIN SHOCK. ELEANOR K. CHAMBERS and K. W. THOMPSON, J. Infect. Dis. **37**:229 (Sept.) 1925.

During the first fifteen minutes of canine histamin shock, there is a decrease of nearly 80 per cent. in the glycogen content of the liver, and a 60 per cent. decrease in the glycogen content of heart muscle and skeletal muscle.

During the first thirty minutes of canine histamin shock, blood sugar increases about 200 per cent., blood lactic acid about 133 per cent., plasma inorganic phosphates about 50 per cent.

These changes are similar to the changes reported by O'Neill and McCullough in canine anaphylaxis, and differ from them mainly in that the maximum changes are not reached until the end of thirty minutes, instead of at the end of fifteen minutes as in anaphylaxis.

EFFECT OF MEDIUM ON RATE OF MULTIPLICATION, VIRULENCE AND HEAT SUSCEPTIBILITY OF HEMOLYTIC STREPTOCOCCUS. T. D. BECKWITH and E. J. ROSE, J. Infect. Dis. **37**:277 (Sept.) 1925.

A certain strain of hemolytic streptococcus has been maintained in a twofold manner over a period of at least five years. It has been cultured continuously in rabbits by intrapleural injection. This is the passage strain. The other has been carried on blood agar. The latter is the stock strain.

Proliferation of the passage strain in infusion broth is much more active than that of the stock strain in the same medium.

For normal rabbits of 3,500 to 4,000 gm., the minimal lethal dose by intrapleural injection of these two strains differs greatly. Three hundred organisms of the passage culture kill, while 166,000,000 organisms of the stock culture are not fatal.

The thermal death point of the passage culture is lower than that of the stock culture by approximately 5 C. when the numbers of organisms thus treated are approximately the same in both instances. A similar difference is noted also when inactivated serum with broth is substituted for the milk.

The same difference in heat susceptibility persists when the reaction of the medium is altered through a range of p_H 5.8 to p_H 8.8.

This difference in relative susceptibility disappears when chemical germicides are used.

STANDARDIZATION OF TUBERCULIN. ASSAY ON THE BASIS OF SPERMATOCYTE REACTION. ESMOND R. LONG, J. Infect. Dis. **37**:369 (Oct.) 1925.

The author discusses the disadvantages of methods of standardization of tuberculin which are based on the action of tuberculin on the hypersensitive tuberculous animal, and those based on the interaction of tuberculin and serum antibodies in the serum of a tuberculous animal.

A method is proposed which is based on the hypersensitiveness of the spermatocytes of the tuberculous guinea-pig to the action of tuberculin. The spermatocyte reaction (previously reported as the testicle reaction) is delicate, and when carried out in the manner described is of greater constancy and reliability than the other methods. Necrosis and subsequent absorption of the spermatocytes is used as the basis for recognizing a positive reaction, and the limiting dilution at which this is observed under the conditions outlined is considered to represent 1 unit of tuberculin.

KENNEDY, Rochester, Minn.

THE EFFECT OF ULTRAVIOLET LIGHT ON THE MINERAL METABOLISM OF THE LACTATING ANIMAL. J. B. ORR, H. E. MAGEE and J. M. HENDERSON. Biochem. J. **19**:569, 1925.

Three balance experiments on lactating goats showed that irradiation of animals by the carbon arc lamp reduced the loss of calcium from the body, accounted for by the decreased excretion in the feces and the increased absorption from the intestine.

THE BICARBONATE OF THE PLASMA AND THE HYDROGEN ION CONCENTRATION OF THE BLOOD OF GUINEA-PIGS SUFFERING FROM SCURVY. E. H. LEPPER and S. S. ZILVA, Biochem. J. **19**:581, 1925.

The titratable alkali of the plasma of guinea-pigs with scurvy is lower than that of normal animals, due to the deficiency of sodium and potassium salts of organic acids in the scurvy-producing diet. Addition of sodium citrate to the diet restores the normal bicarbonate content of the plasma without influencing the scurvy.

THE EFFECTS OF PARATHYROID FEEDING ON CALCIUM AND CREATIN METABOLISM. DOROTHY WOODMAN, Biochem. J. **19**:595-600, 1925.

Administration of extracts of parathyroid has no effect on the weight of adult animals or on the growth of young animals. There is no effect on the deposition of calcium salts in the bone or on creatin metabolism as measured by muscle creatin.

KUGELMASS, New York.

FILTER-PASSING BACTERIA FROM THE RESPIRATORY TRACT, ASSOCIATED WITH INFLUENZA AND ACUTE CORYZA. L. BOEZ, Ann. de l'Inst. Pasteur **39**:833 (Oct.) 1925.

Boez reviews the experimental work on the etiology of the conditions named, particularly that of Olitzky and Gates. A method for the culture of anerobic organisms in a nonprecipitating medium is described.

It was found that the respiratory secretions of patients with influenza could reproduce the disease in man or animals, when introduced into the respiratory tract. Passage through a Berkefeld filter did not alter its efficacy. Leukopenia was typically produced. Animals sacrificed a few hours after inoculation showed pulmonary lesions, with zones of hemorrhage and edema alternating with areas of emphysema. Extracts from such lungs reproduced the condition in other animals. Intratracheal introduction of various organisms after the filtrate of exudate had been administered resulted in development of pneumonia, while administration of the same organisms to animals which had not had the influenzal inoculation was without effect. A minute bacillus was cultivated and isolated from the exudates from cases of spontaneous and experimental influenza, and was found to obey Koch's postulates. It has been termed *B. pneumosintes.* It shows a predilection for the lung, and apparently lowers its resistance to secondary invasion.

Associated with this organism are others which are morphologically similar, but which give rise to different agglutinins, and which have no marked pathogenicity. The *B. pneumosintes* remains viable for months in 50 per cent glycerin solution. Agglutinins for this organism were found in the serums of 70 per cent of a group of twenty-nine persons who had recovered from influenza from six days to five months previously. A group of twenty-two who had never had influenza exhibited no such agglutinins. Vaccine immunization was effective in 20 per cent of human beings vaccinated, but results are considered inconclusive. Agglutinins appeared about the twentieth day.

Olitzky has also described a very small gram-negative anerobic bacillus, found only in patients with acute coryza. Its etiologic significance in coryza has not been definitely established.

BOYD, Iowa City.

INSULIN STUDIES IN THE CHILD. R. FREISE and K. CHOREMIS, Monatschr. f. Kinderh. **31**:1, 1925.

The authors set out to find if insulin had the same effect on conditions of acidosis caused by factors other than diabetes. For this purpose they compared the effects of insulin injections in diabetic children with injections in children made acidotic by a ketogenic diet. The tables show that in both cases the insulin reduced the blood sugar, but that in the ketogenic diet group, the condition of acidosis was unaffected. This was influenced immediately, however, by giving a 10 per cent sugar solution by mouth.

In a further study, the writers investigated the effect of insulin in infections in diabetic children. It was found that during the febrile stage much more insulin is necessary to produce the results obtained than in the nonfebrile period. The same results were obtained in fever produced artificially.

There is also some difference in the reaction to insulin between the diabetic subject and the well person. In the diabetic patient the reaction is more prompt, the depression of blood sugar more marked and the recovery more quick than in the normal person.

GERSTLEY, Chicago.

THE RELATION OF OSTEOMALACIA AND RICKETS TO OSTITIS FIBROSA. F. J. LANG, Virchows Arch. f. path. Anat. **257**:594, 1925.

Lang reports a microscopic study of the bones from nine cases of osteomalacia and ten cases of rickets, the purpose of the investigation being an attempt to evaluate the fibrosis of the marrow and of the trabeculae of the spongy bone and to determine the relation of osteomalacia and rickets to ostitis fibrosa. He concludes that the primary condition in both osteomalacia and rickets is defective calcification of the bone, as the result of which the bones are subjected to static, mechanical and functional factors which act as a stimulus to proliferation of connective tissue, which often has a mucoid character. The fibrosis is a secondary and nonspecific change in both osteomalacia and rickets, and either condition may result in ostitis fibrosa.

SCHULTZ, Chicago.

Nutrition

EXPERIMENTAL RICKETS IN RABBITS. HARRY GOLDBLATT and ALAN R. MORITZ, J. Exper. Med. **42**:499, 1925.

Experimental rickets was produced in rabbits by diets deficient in antirachitic organic factor and phosphorus, but with high calcium content. Rabbits from the same litters given the same diets plus cod liver oil did not develop rickets.

The animals were kept in individual cages shielded from direct sunlight. The food was given by stomach tube in the first series of experiments and in the early parts of later experiments. In the earlier experiments diarrhea developed within a week or two and death of the animals followed. After devitaminized alfalfa hay was added to the diets, diarrhea ceased to develop.

The diagnoses of rickets were based on roentgen-ray findings, the presence of enlarged costochondral junctions and epiphyses, macroscopic and microscopic necropsy findings, and blood chemical examinations.

McCLURE, Evanston, Ill.

CONSTIPATION IN INFANCY AND IN CHILDHOOD. HARRY S. SNYDERMAN, M. J. & Rec. **122**:150 (Aug. 5) 1925.

Constipation is usual during the breast and bottle feeding period. This might be due to lack of solid residue which stimulates the intestines to active peristalsis. Many causes are held responsible for this condition in infancy, such as feeble musculature and anatomic peculiarities. Later, one negative factor is absence of voluntary effort to cultivate regular habits. Fissures of the anus and polyps are much more often the result rather than the cause of constipation. The results of constipation are multiple. In the treatment, the author stresses the importance of forming the habit of having a daily evacuation of the bowels, and favors treatment by properly administered drugs rather than by dietetic measures. He has known of patients benefited by biweekly treatments of the mercury quartz lamp.

WILLIAMSON, New Orleans.

HEMATOPOETIC ORGANS IN RICKETS. S. DEVILLA and G. CARTIA, Pediatria **33**:1, 1925.

Devilla and Cartia found the color index low in almost all cases of rickets. The white cells are either normal or slightly increased, but in no case was a

leucopenia found. The differential white count was found fairly constant and practically normal; in a few cases a moderate increase in the number of lymphocytes was noted. In many cases a few myelocytes (two to four) were found. Examination of the bone-marrow revealed a marked activity; showed an increased production of immature red and white cells. These results are in accord with observations made by others.

DE SANCTIS, New York.

THE PROBLEM OF MILK FOR CHILDREN. LEO LANGSTEIN, Gsndhtsfürs. f. d. Kindesalter **1**:19, 1925.

The author considers the economic aspects of raw milk quickly cooled and kept at low temperature, sterilized by the consumer by boiling and quickly cooling it as compared with pasteurized milk. Pasteurized milk must be heated a second time by the consumer, as pasteurized milk is just as subject to reinfection as raw milk during its transit from the producer to the consumer. This second heating process destroys the vitamin content of pasteurized milk, while raw milk kept at low temperature and sterilized only once before use retains its vitamins.

EHRMANN, Chicago.

HORMONES AND VITAMINS. II. ACTION OF GROWTH VITAMINS IN PROMOTING GROWTH. KURT SCHEER, Jahrb. f. Kinderh. **108**:171, 1925.

The author reviews briefly the various theories propounded to explain the action of the growth vitamin. His investigations are made with the purpose of determining whether vitamin B will in any way influence the swelling of colloids, MacDougal having shown that at least in the first phases of growth the swelling of colloids plays a chief rôle.

In previous experiments, the author has shown that thymus gland substance strongly stimulated colloid swelling. Extracts from other glands of internal secretion did not possess this stimulating property. The action was not due to changes in the hydrogen ion concentration in the surrounding fluids.

The experiments were made with fresh calf muscle and a yeast preparation rich in vitamin B. The results, as tabulated, show a marked increase in the weight of the strips of muscle after a twenty-four hour immersion in a solution containing the vitamin B, composed to control strips of muscle immersed in a similar solution but without vitamin B. The conclusion is that it is through this influence of vitamin B on colloids that cell growth is promoted and therefore body growth.

A close relationship between vitamins and certain glands of internal secretion has long been surmised. Abderhalden, Funk and others considered that vitamins exerted their influence by acting as a stimulant to certain endocrine glands. Numerous necropsy findings have been reported in which the glands of internal secretion, with exception of the suprarenals, showed signs of atrophy, when there had been deficiency of vitamins; the thymus, more than any, even to 50 per cent of its normal weight. Experimenting with young rats fed on a vitamin B free diet, the author was able to promote growth and prolong life by feeding thymus substance. Feeding thyroid substance produced rapid weight loss and early death.

The author concludes that the growth promoting vitamins from yeast and also thymus gland substance exercise a strong influence on colloid swelling, that is, in muscle, and it is probably through this common quality that they promote growth in the young organism.

PARMELEE, Chicago.

THE INFLUENCE OF INSULIN ON THE WATER METABOLISM AND BODY WEIGHT OF INFANTS. S. BUTTENWIESER, Med. Klin. **21**:659, 1925.

The experiments of the author show that insulin has a strong effect on the water retention in hydrolabile infants. Edemas were not seen as a result. In hydrostabile infants the insulin has no influence on the weight and on the water retention.

In dystrophic infants it has a favorable effect on the increase of the weight and on the general condition. The appetite improves under insulin treatment.

YOGHURT MILK IN FEEDING OF INFANTS AND YOUNG CHILDREN. LEMBKE, Med. Klin. **21**:851, 1925.

For institutes in which breast milk is not available, yoghurt milk is a good food for infants.

As a special indication for feeding with yoghurt, the convalescing period of atrophic infants is mentioned by the author.

As a form of therapeutic method yoghurt is recommended in cases of chronic intestinal catarrhs. In acute intestinal catarrhs the results were not encouraging.

ZENTAY, St. Louis.

FAT AND GLYCOGEN CONTENT OF THE LIVER IN THE DIARRHEA OF INFANTS. S. ROSENBAUM, Monatschr. f. Kinderh. **31**:15, 1925.

In a clinical and experimental study, the author concludes that in the infant loss of water leads to increase of fat coincidental with decrease of glycogen in the liver. If there is little fat reserve in the body, marked water loss leads to depletion of glycogen, while fat in the liver is not increased. In some cases the giving of insulin seemed to prevent these changes in the liver but it had no effect clinically on the condition of intoxication.

SOUR MILK MIXTURES IN INFANT FEEDING. H. VOGT, Monatschr. f. Kinderh. **31**:30, 1925.

In a general way Vogt discusses the various forms in which sour milk has been used in infant feeding. He has had the best results with the mixtures advocated by Kleinschmidt. These are combinations of buttermilk with melted butter and flour. There are two types, one with 2 per cent butter and 3 per cent flour, the other with 3.5 per cent butter and 3.5 per cent flour. Later, sugar in its various forms can be added up to 4 to 5 per cent of the total. The advantage of these mixtures over albumin milk is that they can be used early in life, and can be continued indefinitely. Vogt has seen absolutely no bad results from them.

As regards the explanation of the action of the various combinations of sour milk, Vogt is not certain. He discusses a few of the suggestions and is rather inclined to believe that Marriott has offered the most likely. However, he does not commit himself too definitely and believes more work must be done.

INTERNAL SECRETION AND NUTRITIONAL DISEASE IN INFANCY. PAUL HEIM, Monatschr. f. Kinderh. **31**:74, 1925.

In a short article, Heim argues that the symptoms of intoxication in infancy can be explained as a hyperfunction of the suprarenal system and a hypo-

function of the insulin system. The exciting cause is probably dehydration. The liver is also involved in these cases. In decomposition the opposite state of affairs is found, in a vagotonic supremacy, that is, bradycardia, low blood sugar, low blood pressure, and subnormal temperature.

CONTRIBUTION TO THE RICKETS-TETANY PROBLEM. KARL WALTNER, Monatschr. f. Kinderh. **31**:129, 1925.

This is a discussion, chiefly theoretic, based largely on short abstracts from the work of other men, attempting to relate the problem of rickets to the pancreas. The basis of the reasoning is the finding that in tetany as well as in insulin poisoning, there is hypoglycemia.

The article contains few experimental or original observations.

SUBMAMMILARY TEMPERATURE AND MILK SECRETION. V. MOLL, Monatschr. f. Kinderh. **31**:140, 1925.

In a simple but interesting series of experiments, Moll has shown that the temperature taken in the fold between the breast and the thorax is higher than that taken in the axilla if the breast is efficient and secreting. The difference varies from 0.4 to 1.00 C. This observation is of practical value in two ways. In the first, it aids in prognosis. As long as the submammillary temperature is raised, if even only slightly, efforts at reestablishing a failing milk supply should not be abandoned. In the same way, this observation can be used to test the efficiency of the various so-called lactagogues. In doing so, Moll confirmed what we know already from clinical evidence, namely, that the only means of reestablishing and stimulating a failing milk supply is the complete emptying of the breast either by a breast pump or by a strong nursing infant.

THE REDUCTION INDEX OF THE URINE OF ATROPHIC INFANTS. G. TOROK, Monatschr. f. Kinderh. **31**:169, 1925.

The observer followed the studies originally made by Mayerhofer on the organic material in the urine of nurslings. This is determined by titration with potassium permanganate. In the normal child the amount is low.

Torok finds that the organic material in the urine of hungering atrophic infants is increased, thus confirming the idea of their increased metabolism. He believes also that the study of urinary organic material may assist in the diagnosis of avitaminosis, for at times the change due to the addition to the diet of 5 gm. of vegetable is noteworthy.

In atrophic infants the addition of carbohydrate to the diet causes a gain in weight, but it does not always change the urinary index. The writer believes that this is a means of distinguishing true gain from simply an accumulation of water in the tissues. In true tissue gain the urinary organic output is diminished.

GERSTLEY, Chicago.

CLINICAL OBSERVATION ON THE PROPHYLAXIS OF RICKETS. I. JUNDELL, Acta Pediat. **5**:1, 1925.

Premature infants and twins, a group of subjects most susceptible to rickets, were given regular prophylactic treatments with either (1) phosphorized cod liver oil, (2) yolk of egg, or (3) ultraviolet radiation. These three measures were found equally effective in preventing rickets.

It was, however, noted that softening of the skull persisted in a number of these children. This gives support for the belief that craniotabes is not necessarily a manifestation of rickets.

THE RELATION BETWEEN RICKETS AND CRANIOTABES. J. AXEL HÖJER, Acta Pediat. **5**:16, 1925.

The author studied 70 children with true craniotabes (that is, areas of softening in a skull previously hard). More than forty of these infants showed no other clinical evidences of rickets. Administration of cod liver oil failed to prevent the development of the condition in several cases. Roentgenographic studies made in ten cases and studies of the blood in one case failed to show the changes characteristic of rickets. Höjer concludes that craniotabes is not necessarily due to rickets, but may be physiologic.

THE FAT ABSORPTION AND CALCIUM METABOLISM OF PREMATURE INFANTS: A CONTRIBUTION TO THE PATHOGENESIS OF RICKETS IN THESE INFANTS. GRETA MUHL, Acta Pediat. **5**:188, 1925.

Studies were made on five infants gaining weight satisfactorily. The absorption of fat per kilogram of body weight was found to be about the same as in full term infants. In order to maintain this normal fat absorption, it is necessary to give relatively more fat than to a full term infant. The excess fat appears in stools as neutral fat or fatty acid.

Four out of these five children developed rickets while under observation. The diagnosis was made on the symptom of craniotabes alone. The calcium retention was not diminished, as is usually the case in active rickets. Roentgenographic studies were not made, but studies of the blood serum in one subject revealed normal values of calcium and phosphorus. The rickets showed no tendency to yield to repeated ultraviolet ray treatments. One fatal case did not come to necropsy. The author concludes from this material that she is dealing with a new type of rickets occurring only in premature (and perhaps in full term breast fed) children. This form of rickets is characterized by resistance to cod liver oil and ultraviolet ray therapy, by good retention of calcium, and, apparently, by normal calcium and phosphorus in the blood serum. She suggests that this form of rickets is due to a deficiency of some central depot of calcium in the premature child. Feeding of calcium salts may be of benefit.

The author cautions against feeding premature children more than just enough to make them gain weight. Overfeeding is likely to produce "dyspeptic" stools with consequent loss of calcium from the intestine. She also cautions against taking their temperature too frequently. In such small infants the insertion of the thermometer in the rectum "often gave rise to a mucous discharge."

STUDIES ON CALCIUM DIALYSIS FROM COW'S MILK AND HUMAN MILK. YNGVE ZOTTERMAN, Acta Pediat. **5**:190, 1925.

The author has studied the effect of adding hydrochloric acid to the dialysable calcium of these two milks. The dialysable calcium reaches a maximum at p_H 4.6, corresponding roughly with the iso-electric point of casein. If the acidity is increased beyond this point, the dialysable calcium is slightly decreased, for a reason which is not clear.

Owing to its higher phosphate content, cow's milk has a greater buffer value; hence it requires about four times as much hydrochloric acid to bring cow's milk to the point of maximum calcium diffusibility, p_H 4.6.

The author concludes that the high buffer value of cow's milk is a factor which must be considered in infant feeding. The stomach is required to secrete more hydrochloric acid on cow's milk diets.

HOLT, Baltimore.

Prenatal Conditions

A CONGENITAL ANOMALY OF THE PATELLA. CASE REPORT. A. W. GEORGE and R. D. LEONARD, Am. J. Roentgenol. **13**:271 (March) 1925.

In this anomaly, the upper and outer quadrant of the patella consists of a separated piece of bone. This separated bone tissue may consist of one or two fragments. They usually have a smooth outline and their periphery is cortical bone. The majority of cases are bilateral and this assists in the differential diagnosis.

STULIK, Chicago.

CONGENITAL ABNORMALITIES OF THE INTESTINE. R. E. FARR and C. W. BRUNKOW, Arch. Surg. **11**:417 (Sept.) 1925.

Congenital occlusion of the bowel is a rare condition, being regarded as occurring once in 15,000 or 20,000 infants. It is quite probable, however, that many cases are unrecognized or if recognized are not reported. Little is known as to the true etiology, although several theories have been advanced, the chief of which are as follows:

1. The pressure of adhesive bands that have formed as a result of some intra-uterine infection.
2. Blocking of the vessels of a part of the mesentery, as in a sclerosis, resulting in imperfect development of that section of the bowel.
3. General infections.
4. Volvulus of a loop of bowel.
5. Pressure of surrounding organs on an isolated loop of bowel.
6. Embryonic defects.

While each of these causes has been based on good evidence, it is quite probable that in the vast majority of cases the last plays the important rôle, especially because these atresias occur most commonly at the sites where abnormal development is most apt to take place, namely, in the duodenum and the ileocecal region.

The type of defect may vary from a simple narrowing, formation of a partial or complete diaphragm, to the formation of a blind ending of the bowel which is separated from the distal segment either by a narrow cord or by a wide gap in the mesentery.

The symptoms are those of intestinal obstruction but vary in the severity and character with the level of the lesion.

Vomiting is almost constant and is early seen. The material brought up may be simply mucus, or it may contain bile, blood or meconium, depending on the site of the obstruction. There may be an entire absence of anything passed by rectum if the atresia is low down, or one may see only plugs of mucus if the cecal region is involved. When meconium is present and its color is normal, the probability is that the obstruction is above the ampulla of vater, but a meconium without the normal color may be passed when the

jejunum or ileum is involved. Evidence obtained with the barium enema or the barium meal is often of great value and should be used more commonly. The absence of abdominal distention may mean a high obstruction; the presence of a marked distention may signify one low down.

The prognosis of these congenital atresias, in spite of the best efforts, is extremely bad, as only two or three successful results appear in the record. Expectancy is always fatal, but even after ileostomy, gastro-enterostomy or entero-enterostomy performed under local anesthesia, recovery can hardly be expected.

Atresia of the anal region occurs more often than that higher up in the bowel, and is often associated with a peristent connection with some part of the urinary portion of the cloaca. The symptoms are those of a low-lying obstruction, unless an outlet is present through the bladder, urethra, or vagina. In either case the condition is readily recognized, and in most cases can be satisfactorily treated. This may require a simple puncture of the membrane between the intestine and the ectoderm, or it may necessitate an anastomosis of the rectum and anal canal, closure of a urinary fistula or a combination of these with a colostomy.

HIRSCHSPRUNG'S DISEASE OR CONGENITAL MEGACOLON. O. HOFMANN and G. H. EWELL, Arch. Surg. **11**:674 (Nov.) 1925.

While a few isolated cases were reported previously, this condition was first described in detail by Hirschsprung as an idiopathic disease in 1886. This condition is quite rare, occurs usually in males and seems to be hereditary.

Etiology: This is a matter of speculation, and many theories have been advanced as to the cause. Among them may be mentioned: 1. Congenital obstruction of the bowel below the dilated gut. 2. A neuromuscular defect resulting in a relaxation and ballooning up of a definite segment. 3. Valve formation in the lining of the colon, usually in the rectum. Finney attributes the condition to no single factor, but rather a combination of a long mesentery, chronic colitis, spastic contractions of the sphincter muscle, connective tissue hyperplasia of the rectum, increased length of the sigmoid, and lymphangiectasis. David found in three cases a stricture of the rectum, but the associated dilatation of the bowel was not recognized as a true idiopathic Hirschsprung's disease.

Pathology: In most cases the dilatation is limited to the sigmoid, but occasionally the entire colon including the rectum is involved. Unlike the ordinary intestinal obstruction, the bowel above the dilated segment is of normal caliber. The dilatation may be enormous, measuring at times as much as 70 cm. in circumference. The changes in the wall of the dilated part are variable, for at times there is a definite hypertrophy, sometimes no apparent change at all, and not infrequently a marked thinning out, even to transparency. The retained fecal material usually is of large amount and contains fatty acid and particles of phosphates. The mucosa is flattened out, often is pigmented, and may be ulcerated from pressure.

The diagnosis of a typical case should not be difficult, with a good history, careful physical examination and a colon fluoroscopy.

Treatment: Proper diet is essential and at times much may be accomplished with colonic flushings. The aim is to remove surgically the affected segment of bowel, but this is usually impossible until an ileostomy or colostomy has been previously done, and the colon irrigated for a long time.

Prognosis: Ladd reports a mortality of 67 per cent in sixty cases treated medically, and a mortality of 41 per cent of fifty-eight cases treated surgically. Patel claims a cure in 57 per cent of seventy-four children, and the same percentage of forty-one adults treated surgically.

The author reports a case in a boy, aged 8 years, giving a history and physical findings typical in every respect. A cecostomy was done and the colon was irrigated through this opening; a marked improvement followed. A resection was contemplated, but the day previous to the proposed operation an attack of dyspnea with cyanosis occurred, resulting fatally. Permission for necropsy was not obtained.

MILLER, Chicago.

CONGENITAL DUODENAL SEPTUM WITH OBSTRUCTION. S. M. SEIDLIN, Bull. Johns. Hopkins Hosp. **37**:328, 1925.

The occlusion in this case was caused by a perforate iris-like septum stretched across the lumen of the duodenum at the site of the ampulla of Vater. The patient, a child, had lived an apparently normal life for two and one-half years in spite of the septum. While breast fed and given soft diet, the food easily passed through the small opening in the septum, but the use of coarser food had produced an acute obstruction of this opening. The etiology of this and similar occlusions is discussed.

[ARCH. PATH.]

CONGENITAL CYSTS OF THE LUNG. AMOS R. KOONTZ, Bull. Johns Hopkins Hosp. **37**:340, 1925.

This appears to be the first recorded American case of congenital cysts of the lung. From the European literature, mostly German, the author has collected 108 cases, which are tabulated. In the case reported constriction of the bronchioles with dilatations of the distal parts had lead to multiple cyst formation. The constrictions of the bronchioles depended on the excessive development of the mucous membrane, the possible causes of which are discussed on the basis of the tentative explanations advanced in previous reports.

[ARCH. PATH.]

A STATISTICAL AND CLINICAL STUDY OF CONGENITAL DEBILITY. F. WEISS, Med. Klin. **21**:1192, 1925.

During the war period there was only a very small increase in the incidence of congenital debility; a higher degree of debility (lower birth weight) was not to be found in this period. Malformations were not more frequent in debilitated than in fully developed babies. Etiologically, disease of the mother, chiefly syphilis, is of importance. The mortality averaged 32.3 per cent, the maximal point being in 1919, with 52.3 per cent. The mortality of debilitated children born to syphilitic mothers was not higher than the total mortality, while the mortality of those of tuberculous mothers shows much higher figures.

Artificially fed babies showed a mortality about one-third higher than the average. Hemorrhages, chiefly intracranial, were found in one-fifth of the necropsies. Infections were found in seven-eighths of the necropsies. Of 136 subjects only seventy-eight were able to nurse at the breast. Mother's milk, especially through the bottle, did not prove to be the entirely adequate food for debilitated babies.

For artificial feeding, mixtures with high fat content were used with good results (butter-flour-milk of Kleinschmidt). Sodium chlorid therapy, as used

in former years, caused a "salzschädigung" in many cases. Parenteral protein therapy in the form of serum produced in the majority of cases an improvement of activity, nursing and general condition.

Concerning rickets and anemia the findings did not show anything new.

ZENTAY, St. Louis.

CONGENITAL CYSTIC KIDNEY AND DEFECT OF DIAPHRAGM. H. HOOK and H. U. KALLIUS, Virchows Arch. f. path. Anat. **257**:202, 1925.

The association of a congenital cystic left kidney with congenital absence of the left half of the diphragm lead to the conclusion that the cystic kidney resulted from a factor acting locally on the posterior abdominal wall in the region of the primitive kidney. Cystic kidney arises from renal tubules which remain rudimentary as the result of an embryonic maldevelopment which inhibits normal differentiation of the tubules.

SPINA BIFIDA AND AMNIOTIC ADHESION. H. FERIZ, Virchows Arch. f. path. Anat. **257**:503, 1925.

A child with spinal bifida also had marked congenital elephantiasis of a finger. The latter anomaly was due to an amniotic adhesion. From the combination of the two anomalies present, the author concludes that amniotic adhesions and bands are the result of the same factors which cause the so-called endogenous malformations, or are the result of the latter.

SCHULTZ, Chicago.

Diseases of the New-Born

A CASE OF HEMORRHAGIC DISEASE OF THE NEW-BORN. J. M. GRAHAM, Edinburgh M. J. **32**:190 (Sept.) 1925.

An infant, a girl, who was well until the third day following a normal birth, had a profuse hematemesis. Nosebleed and hemorrhage from the rectum also occurred during the next day. The bleeding time was found to be prolonged. Jaundiced skin, anemia and collapse soon appeared. Two intramuscular injections of maternal blood were without effect. A transfusion of 15 c.c. of citrated blood for each pound of the child's weight was given into the internal saphenous vein at the ankle. The improvement was immediate and no further bleeding occurred. Graham regards the case as one of hemorrhagic disease, and states that transfusion rarely fails to stop the hemorrhage; it restores the vitality of the child.

NEFF, Kansas City, Mo.

THE SCHICK TEST IN MOTHERS AND THEIR NEW-BORN INFANTS. A. RONCHI and F. REDLICH, Pediatria **33**:617, 1925.

Ronchi and Redlich did the Schick test in a series of 100 mothers and their new-born infants; the test being done in the first week after the birth of the infants. The usual technic with control tests as described by Schick was followed. In the series studied, fourteen of the infants showed a positive reaction and eighty-six a negative reaction. It was also noted that the skin reactions were much milder and disappeared more quickly in the infants than in the mothers who gave a positive reaction. The pseudoreaction was observed in fourteen mothers and in only two infants. Two mothers gave a positive

reaction whose infants were negative. These results are in accord with the observations made by others; namely, that the vast majority of new-born infants are immune to diphtheria and give a negative Schick reaction.

DE SANCTIS, New York.

CONTRIBUTION TO TUMOR PATHOLOGY. 1. THE GENESIS OF TERATOMA DIPHYLLICUM. 2. DURAL IMPLANTATION OF METASTASES IN NEUROMA OF CEREBELLOPONTINE ANGLE. A. SCHMINKE, Beitr. z. path. Anat. u. z. allg. Path. **73**:502, 1925.

In a 12 day old child, congenital malformation of the left lower extremity was associated with multiple internal maldevelopments and a teratomatous tumor composed of entodermal derivatives and neurogenous tissues. Schminke believes that the tumor arose as the result of the same mechanical factor that caused the development anomalies and that it could not have arisen from a totipotent blastomere. The bilateral acusticus tumor described was unusual in that it was a neurinoma, not an endothelioma or psammoma. Multiple small dural tumors present were believed to have arisen by implantation.

SCHULTZ, Chicago.

DERMATITIS EXFOLIATIVA NEONATORUM. OSCAR HERZ, Monatschr. f. Kinderh. **31**:60, 1925.

A new-born infant developed a typical case of dermatitis exfoliativa. During the course of the disease, the attending nurse developed a typical vesicle on her finger, the contents of which showed staphylococcus. The writer considers this observation a good argument for the staphylococcus origin of the disease.

GERSTLEY, Chicago.

Acute Infections

THE TREATMENT OF SCARLET FEVER WITH ANTITOXIN. FRANCIS G. BLAKE and JAMES D. TRASK, Boston M. & S. J. **193**:659 (Oct. 8) 1925.

This report is based largely on a study of fifty-seven cases of uncomplicated scarlet fever (specific toxemia due to streptococcus scarlatinae without significant invasion of the body tissues by the organism); forty-eight cases with septic complications (due to a local or general invasion of the body by the streptococcus scarlatinae or other pyogenic organisms, as represented clinically by purulent rhinopharyngitis and sinusitis, otitis media, mastoiditis, ulcerative tonsillitis, cervical adenitis, arthritis, thrombophlebitis and septicemia), and seven cases of postscarlatinal sepsis, treated with Dochez's unconcentrated anitoxin by intramuscular injection.

The patients with uncomplicated conditions were all promptly cured within twelve to thirty-six hours, irrespective of the severity of the disease at the time of treatment. All but five remained well (two cases of mild nonsuppurating cervical adenitis appearing late in convalescence, one case each of otitis media, transient fibrinous pleurisy, and acute nephritis). Of the forty-eight complicated cases, all but one were promptly and permanently cured of the specific toxemia phase as shown by fall of temperature, rapid fading of the rash and prompt neutralization of toxin in the blood. Their septic complications, however, were not immediately cured but subsided more or less rapidly depending on the nature, duration and severity of the complications. One patient extremely ill died on the eighth day after one injection of 40 cc. of antitoxin,

while five patients developed additional complications (three otitis media, one otitis and mastoiditis, and one nonsuppurative cervical adenitis and arthritis). In the seven cases of postscarlatinal sepsis, no demonstrable benefit resulted. Of the 112 cases, sixty-six were treated on or before the third day, thirty-six from the third to the seventh day, three with the rash still present from the eighth to the tenth day, and seven patients with faded rash from the fifth to the twenty-seventh day. The authors found that to be therapeutically efficient in reasonable dosage, an antiscarlatinal serum should contain at least 12,500 minimal blanching doses (M. B. D.) of antitoxin per cubic centimeter, or be able to neutralize at least 10,000 skin test doses of toxin per cubic centimeter, and should be used in doses of 30 to 120 cc. depending on the size of the patient and the severity of the disease (children, from 30 to 80 cc.); and also that to obtain the best therapeutic results the full amount of antitoxin required in each case should be estimated and given at once as soon as the diagnosis is made.

They do not advocate the giving of the antitoxin to children who have been exposed because of the possibility of serum sickness and because of the efficacy of the antitoxin when given early in the disease.

THE MORBIDITY AND MORTALITY OF DIPHTHERIA. DWIGHT M. LEWIS, Boston M. & S. J. **193**:913 (Nov. 12) 1925.

An interesting discussion with charts, attempting to show the influence of other epidemic diseases, especially measles, on the already high morbidity and mortality of diphtheria. The author's conclusions are that diphtheria mortality would seem dependent in the main on measles epidemics for its excesses and variations; that the same streptococcal complications as kill in measles and bronchopneumonia may likewise later take a similar toll from diphtheria. Epidemiologically, biologically and statistically, the author is satisfied that he can control the morbidity of diphtheria by the finding and elimination of carriers (nasal and throat) both virulent and avirulent during and following all respiratory infections, measles in the main, but is not as satisfied that equally satisfactory results are constantly obtainable in the control of mortality from diphtheria. That when cultures are returned not as negative for diphtheria, but positive for the predominant organism or organisms, the as yet hidden factor in a part of the excessive varying mortality from diphtheria will be solved.

CHEMICAL STUDIES OF THE BLOOD IN PNEUMONIA. 1. A METHOD OF CONSTRUCTING AN ALIGNMENT DIAGRAM TO REPRESENT CHANGES IN THE GASEOUS COMPOSITION OF THE BLOOD AND CHANGES IN THE ELECTROLYTE CONCENTRATION OF THE PLASMA. THOMAS E. BUCKMAN, F. DENNETTE ADAMS, MILLARD SMITH and H. T. EDWARDS, Boston M. & S. J. **193**:997, 1925.

The report of these studies made in the Department of Pediatrics, Harvard Medical School, is summarized as follows:

1. There are presented in this paper oxygen dissociation and carbon dioxid dissociation curves of oxalated human blood drawn from original data, and also curves showing the relation shift in the sodium chlorid content of the plasma with increasing bicarbonate content of the blood.

2. From these data a nomogram has been constructed, and is here presented, showing quantitatively the association of changes in the carbon dioxid tension and oxygen percentage saturation with oxygen tension, bicarbonate content

of whole blood and plasma, hydrogen ion concentration and sodium chlorid content of plasma.

3. Two methods, based on the relationships shown in this nomogram, have been described for the construction of diagrams in which are aligned the following factors: carbon dioxid tension and bicarbonate content of whole blood and plasma, oxygen percentage saturation of the whole blood, sodium chlorid content of the plasma, and hydrogen ion concentration of the whole blood and plasma. The method of determining the loci of arterial and venous points on these diagrams has been described, and illustrations of the use of such charts as computing diagrams have been given.

4. Finally, the significance of each of these factors in the physicochemical system of the blood has been discussed, and the importance which might attach to this method of analysis in the study of disease has been intimated.

GENGENBACH, Denver.

THE GRADUAL DECREASE OF THE ACTIVE IMMUNIZING VALUES OF TOXIN-ANTITOXIN MIXTURES STORED DURING ONE YEAR. EDWIN J. BANZHAF, J. Immunol. **9**:451, 1924.

Banzhaf, of the Research Laboratories of the Department of Health of New York City, found that toxin-antitoxin mixtures, which cause paralysis in the guinea-pig in 3 c.c. doses and paralysis with death in 5 c.c. doses, were still toxic enough for use in immunization, but that those mixtures which failed to cause death with paralysis in 5 c.c. doses were too weak.

TITRATION OF DIPHTHERIA TOXIN AND ANTITOXIN BY RAMON'S FLOCCULATION METHOD. STANHOPE BAYNE-JONES, J. Immunol. **9**:481, 1924.

By careful experimentation with various diphtheria antitoxins, Bayne-Jones has confirmed the adequacy of Ramon's flocculation technic for their titration.

ON THE SUSCEPTIBILITY TO DIPHTHERIA (SCHICK TEST POSITIVE), WITH REFERENCE TO THE INHERITANCE OF BLOOD GROUPS. HANNA HIRSZFELD, L. HIRSZFELD and H. BROKMAN, J. Immunol. **9**:571, 1924.

In an interesting study of the blood groups and the Schick reaction in fifty families, the authors conclude that the susceptibility to diphtheria is inherited with the blood group, or, rather, that the physiologic capacity to form diphtheria antitoxin is inherited with the blood group, that this capacity may not become active until the immunologic maturity of the person or until the action of some external stimulus, such as the disease itself or active immunization. If the individual inherits the blood group of a susceptible parent, he will remain susceptible, or produce antitoxin only temporarily. There are, then, at various ages, temporarily and constantly susceptible children, differing in immune biologic respects associated with blood groups.

GUY, Peking.

FURTHER STUDIES ON A DIPLOCOCCUS IN MEASLES. A MEASLES SKIN REACTION. RUTH TUNNICLIFF, J. Infect. Dis. **37**:194 (Sept.) 1925.

Anerobic dextrose broth cultures of the green-producing diplococcus found in measles killed by 0.5 per cent. carbolic acid, appear to produce a skin reaction in persons who have not had measles, but not in measles patients after the appearance of the eruption, or in 96 per cent. of persons who give a history of

measles. The measles antigen is neutralized in persons who have not had measles, by convalescent human measles serum, but not by the serum of a person with a negative history of measles. Reaction occurs also in normal rabbits, while rabbits immunized against measles fail to react. The measles antigens are neutralized in rabbits by convalescent human measles serum and by the serum of goats recovering from the reaction produced by measles diplococci, but not by normal goat serum. Green-producing cocci from other sources generally give no reactions in rabbits, but the strains that do, produce similar reactions in both immune and in nonimmune rabbits and are not neutralized by measles serum from convalescent patients. Normal rabbit serum neutralizes measles antigen partly, immune rabbit serum completely neutralizes it.

The author states that these results indicate that the gram positive, green producing diplococcus found in measles is of etiologic significance.

KENNEDY, Rochester, Minn.

INFECTIOUS MONONUCLEOSIS IN CHILDHOOD. MURRAY HAROLD BASS and HAROLD HERMAN, M. Clin. N. Am. **9**:589 (Nov.) 1925.

In 1913, Cabot described a condition closely resembling the glandular fever of Pfeiffer, characterized by a striking relative and absolute increase in the mononuclear cells of the blood, which he called "infectious mononucleosis." Following a nasopharyngitis, a more or less generalized adenopathy develops, with enlargement of the spleen, and a low grade fever. The course is often prolonged over a period of months, but almost invariably ends in complete recovery of the patient. Differentiation of this usually benign condition from leukemia may be difficult. The two points of importance in the hematologic picture of infectious mononucleosis are the absence of any immature or abnormal forms of white cells, and the slight degree of anemia. Several cases are reported illustrating the symptomatology of this condition and the problems of differential diagnosis.

TRANSITORY BLINDNESS AFTER CHICKENPOX. BRET RATNER, M. Clin. N. Am. **9**:809 (Nov.) 1925.

A boy, aged 4½ years, became suddenly blind nine days after a mild varicella. His only complaint was loss of vision. The external eye was normal. The right disk was pale and the left was congested and swollen. The blood Wassermann test was negative. The urine was normal. A roentgenogram of the skull and accessory sinuses showed no abnormalities. The vision gradually returned, and was apparently normal in ten days.

"Fleeting amaurosis," or temporary blindness following acute infections, may be caused either by pressure from blocking of the foramen of Majendie, or by retrobulbar neuritis of toxic origin. This case belongs to the later group. The prognosis in either instance appears to be hopeful, though some pathologic condition of the optic nerve may persist.

SMITH, Ogden, Utah.

ENDROCRINES IN RELATION TO RHEUMATIC FEVER AND RHEUMATOID ARTHRITIS. L. J. LLEWELLYN, M. J. & Rec. **121**:618 (May) 1925.

In this article, the author points out that we have for a long while considered the etiology of rheumatism and rheumatoid arthritis to be an infection, but have neglected to search for the reason why the joints of some children are so much more liable to have the infection than the joints of others.

He then gives argument to prove that an endocrinopathy in certain children renders their joints more susceptible to this infection and states that in certain cases where salicylates have failed to give results, thyroid therapy has given relief. The author further states that the glands at fault are usually the thyroid and parathyroids, and that these defective glands which may be either hyposecretory or hypersecretory are generally inherited from one or from both parents.

WILLIAMSON, New Orleans.

ACUTE ILEOCOLITIS IN CHILDREN. ROBERT CRUICKSHANK, Quart. J. Med. **18**:339, 1925.

The investigations in this paper are concerned with ileocolitis, which is defined as diarrhea accompanied by fever and toxic symptoms in which the stools are mucoid in character and contain blood and pus. From the clinical aspect, the condition as it occurs in Glasgow differs considerably from what is included under the same name or under "bacillary dysentery" in this country. It is apparently less common, and occurs spasmodically throughout the year without increase in incidence in the summer months. Only one out of the twelve cases occurred in a child under 1 year of age, and six cases were in children of between 2 and 10 years. The more advanced age of the patients probably explains the low mortality, for only one died. In other respects the description tallies with that of the disease in this country. The Flexner dysentery bacillus was isolated from seven of the twelve patients. In the other five no organism was implicated as causing the disease. In one case with marked toxic symptoms, antidysentery serum (Flexner type) was given subcutaneously, and the author considers the improvement in symptoms to have been due to its use.

JOSEPHS, Baltimore.

ETIOLOGY OF GERMAN MEASLES. M. SINDONI and P. RITOSSA, Pediatria **33**:57, 1925.

Sindoni and Ritossa cultivated gram positive filtrable cocci and diplococci from the blood of patients with german measles. The organisms grew in small numbers exclusively anaerobically on catalyzing mediums. They are not pathogenic for rabbits. Intramuscular injections of the tenth generation of the cultivated organisms in man produced symptoms resembling german measles.

DE SANCTIS, New York.

STUDIES ON SCARLET FEVER. I. JUNDELL, Acta Pediat. **5**:166, 1925.

This is a report of a large number of Dick tests performed by the author on patients with scarlet fever, convalescents, and normal persons. The tests were made with filtrates from organisms which the author had isolated several years ago, from the tonsils of patients with scarlet fever.

In general, the results are in agreement with those of the Dicks and Zingher. A negative Dick test follows the attack in a considerable number of cases. The author observed several epidemics of scarlet fever in persons who had the Dick test. Only one such epidemic is reported in the present paper. With

one possible exception, the twenty-three cases of scarlet fever were confined to persons with positive reactions to Dick tests.

The author finds that a single strain of streptococcus scarlatinae may vary considerably from time to time in its toxin-producing capacity.

Skin tests were performed with filtrates of hemolytic streptococci not belonging to the scarlet fever group. Only one person was found who gave a positive reaction.

HOLT, Baltimore.

SCHICK'S REACTION IN GREENLAND. E. BAY-SCHMIDT, Ugesk. f. Læger **41**:889, 1925.

The Schick reaction was studied in 283 patients, ranging in age from birth to 70 years. It was found in the age groups tabulated that from birth to 2 years there were 42 per cent positive reactions; from this high incidence there was a marked decrease to 13 per cent at 15 years, after which there was a rapid rise to 65 per cent at 21 years. At 25 years, the incidence of positive reactions had dropped to 51 per cent, which appears to be a constant for the remaining years of life.

The author concludes that immunity is relatively small among these colonists.

SOME ATYPICAL EXANTHEMAS. HANS HECKSCHER, Ugesk. f. Læger **43**:923, 1925.

A series of thirty-five patients, twelve of whom were children under 15 years, were under observation for the various exathematous diseases because of atypical skin rashes. In five of these, the author thinks the rash may have been due to pilocarpine, quinine, arsenic, medinal or sodium salicylates. In the others, organic diseases being ruled out, there were catarrhal inflammations, conjunctivitis, inflammation of fauces, and in five cases tonsillar membranes not due to the diphtheria bacillus.

The author thinks, because of the short duration of these rashes, slight fever and atypical course from the recognized exanthematous diseases, that they should be classed in a group called "exanthemata non typicum." This, of course, means nothing, because many of the cases described in this paper may be properly classified.

SCHLUTZ, Minneapolis.

Chronic Infections

EXTRACTS OF NORMAL TISSUES IN EXPERIMENTAL TUBERCULOSIS. RICHARD S. AUSTIN, J. Infect. Dis. **37**:256 (Sept.) 1925.

The inoculation of simple extracts, not incubated, of certain fresh normal organs of the rabbit appears to influence the development of experimental tuberculosis in rabbits. The extracts of different kinds of organs vary considerably as to the amount of influence displayed. Suprarenal and lung extracts frequently would seem to retard the development of the disease, those of the heart and liver produce less effect, as a rule, while extracts of spleen and kidney exert little or no influence. The freshness of the organs used, the short time utilized in preparing the extracts, the avoidance of incubation and the preservation of the extracts, between inoculations, at icebox temperature make it seem possible that the more or less protective substances present in some of the organ extracts exist in the organs before removal from the animal.

KENNEDY, Rochester, Minn.

A Simple and Sensitive Modification of the Wassermann Test. E. E. Ecker, J. Lab. & Clin. Med. **11**:76, 1925.

The modification described is based on the well-known fact that an excess of amboceptor (5 units) will eliminate the rôle played by the natural antisheep amboceptor present in the patient's serum. It also allows a sharp complement titration, which is done in a 1:30 dilution. In the test, however, the pooled complement is added from the 1:10 dilution. The amboceptor is glycerolated (50 per cent), and the cell suspension is standardized by Sahli's method or by Hopkins tube. The antigen is the acetone insoluble fraction. To prepare, extract 30 Gm. of beef heart powder in an Erlenmeyer flask with attached coil-condenser for three or four hours, using chemically pure acetone (200 cc.). Chill the mixture in the icebox, filter and dry the residue until the acetone is evaporated. Reextract the residue in the same apparatus with 95 to 100 per cent methyl alcohol (200 cc.) for three or four hours. Evaporate down to 90 cc. The antigen may be cholesterolized with 0.2 per cent cholesterol if so desired. Titrate with strong, weak and negative serums, titration with a weak serum being important. Citron's three tube method is employed and over-night fixation with 2 units of complement. Spinal fluids can be employed in doses up to 1 cc., and for quantitative work the serum of the patient is diluted. The reaction is simple, reliable and specific. No false reactions have been obtained in cases of scarlet fever, malaria or pregnancy.

E. E. Ecker, Cleveland.

Pulmonary Tuberculosis in Early Infancy Simulating Bronchial Asthma. Bret Ratner, M. Clin. N. Am. **9**:826 (Nov.) 1925.

Four cases of pulmonary tuberculosis in infants are reported, in which marked asthmatic breathing was present. There was a low grade fever, and relief was occasionally obtained from epinephrin. However, there was complete absence of probably the most characteristic feature of asthma, namely, paroxysms. As opposed to the active bronchoconstriction of true asthma, the disturbance of respiration in these cases was due to a passive bronchoconstriction from narrowing of the tube by tuberculous bronchial lymph nodes.

Smith, Ogden, Utah.

Tuberculosis of the Hip in Children. Herbert E. Coe, M. J. & Rec. **122**:144 (Aug. 5) 1925.

The author discusses the etiology, anatomy and pathology of tuberculosis of the hip. He then gives the symptoms and signs of the disease, and points out how the pathologic changes of the joint causes the various symptoms. Under diagnosis he mentions the limp, the slight thickening of the head of the femur, limitation of motion as early signs, and in advanced cases, night cries, general malaise, loss of appetite, fever and loss of weight. In treatment he first tries to build up the general resistance of the child by the usual measures, which apply to tuberculosis in any part. He suggests we should refrain from the use of tuberculin until we are more familiar with the phenomenon of anaphylaxis, lest we might produce hypersensitization. Extensive removal of diseased bone should be reserved for the most advanced cases, and only then when other methods have failed to produce results. To prevent deformity and to restore function, he advises rest in bed with sufficient traction to the affected limb to overcome spasm. After one or two months, a Bradford tractor abduction

splint should be fitted and the child should be allowed to walk about. Prognosis is good if treatment is begun early. If treatment is begun late, there will probably be limitation of motion, slight shortness and perhaps ankylosis. Patients in whom there are abscesses and sinus trouble have a worse prognosis than others.

TREATMENT OF TUBERCULOUS JOINTS IN CHILDREN. PAUL C. COLANNA, M. J. & Rec. **122**:155 (Aug. 5) 1925.

Most surgeons at present prefer to pursue a more conservative course to operation, and they aim at restoration of function rather than ankylosis. Open air hospitals in the treatment of tuberculous children should be more generally established at the seaside and in the mountains.

WILLIAMSON, New Orleans.

THE ETIOLOGY OF TUBERCULOSIS IN THE SECOND PERIOD OF CHILDHOOD. ROBERT DEBRE and FRANCOIS CORDEY, Rev. franç. de Pédiat. **1**:16, 1925.

In order to determine what type of contact is necessary for the development of tuberculosis in childhood, the authors studied the environmental conditions of three groups of children. The first group consisted of 230 children showing active tuberculosis, particularly with bone, joint or chronic pulmonary manifestations. In 150 of these, a prolonged intimate contact with a tuberculous person was definitely established. In the remainder of the cases with one exception, there was either a probable prolonged contact, an incomplete history or bad hygienic conditions. The second group consisted of twenty-five children showing a negative cutaneous reaction. In only five of these was there a history of contact; in two, the contact was only occasional, and in the other three there had been no expectoration. The third group consisted of fifty children giving positive cutaneous reactions but no clinical evidence of tuberculosis. In twenty-seven, no contact was demonstrable; in five there was a doubtful history and in eighteen a certain history, although in only eight was the contact at all prolonged or intimate; moreover, it is probable that these eight may later give evidence of tuberculosis. The authors conclude that prolonged contact with a person presenting active pulmonary tuberculosis occupies the exclusive rôle in the etiology of chronic tuberculosis in childhood.

THE ETIOLOGY OF TUBERCULOSIS IN THE SECOND PERIOD OF CHILDHOOD. II. THE CIRCUMSTANCES OF TUBERCULOUS CONTAGION IN RELATION TO THE SEAT AND NATURE OF THE LESIONS. ROBERT DEBRE and FRANCOIS CORDEY, Rev. franç. de Pédiat. **1**:158, 1925.

As in the first article, the authors emphasize the long period of contact with a tuberculous individual, which must take place before a child from 5 to 15 years of age presents lesions of chronic tuberculosis. Unlike the infant, through successive contacts, a child develops a certain resistance, and his reactions are manifestations of an allergic state. An analogy is drawn to syphilis, in which the bone and joint lesions of tuberculosis are said to compare with the secondary stage, and the ulcerative caseous pulmonary manifestations with the tertiary stage. The statistics seem to bear this out, as most cases of bone and joint tuberculosis have their beginning about two years after the first contact, whereas the greater number of cases of pulmonary tuberculosis are detected clinically about five years after the first contact. The location of the tuberculous lesion in the child does not, then, depend on his age but on the duration of his allergic state.

On the other hand, in tuberculous meningitis and miliary tuberculosis a long period of contact is not demonstrable, and the infection falls on new ground or on ground where the allergic state has existed for only a short time. In this connection, resistance seems to vary directly with the duration of the allergic state.

Among other considerations the authors feel that the effect of trauma in producing bone and joint lesions, and the influence of other diseases in precipitating a clinical manifestation of tuberculosis has been overestimated.

LESLIE, Chicago.

THE SACHS-GEORGI TEST IN HUMAN MILK. G. CASTORINO, Pediatria **33**:650, 1925.

Castorino adds to human milk a small amount of kaolin and allows it to remain in the icebox for twenty-four hours. Subsequent centrifugation gives a clear fluid. The Sachs-Georgi test was less frequently positive than the Wassermann test on the same human milk. His material consisted of milk from fifteen syphilitic and seventeen nonsyphilitic women. He concludes that neither the Wassermann nor the Sachs-Georgi tests are reliable when done with human milk.

DE SANCTIS, New York.

STABILE RECURRENT SCARLET FEVER-LIKE ERUPTION IN A CASE OF TUBERCULOSIS OF THE LUNGS. A. SCHOCK, Dermat. Wchnschr. **80**:197 (Feb. 7) 1925.

In a case of tuberculosis of the lungs the author reports a perifollicular, reddish, macular eruption of universal distribution, including the soles and palms. The eruption became more evident by its deeper color and was accompanied by itching after each severe paroxysm of coughing. True scarlet fever eruption and foreign protein rashes were ruled out by observation and the use of the protein skin tests. The author takes occasion at this point to state that in his hands these skin tests are of doubtful value. Biopsy of the involved skin showed only moderate perivascular infiltrate made up of eosinophils, lymphocytes, plasma cells and some mast cells. No tuberculosis bacilli could be demonstrated, and animal inoculation was not done. The name scarlatiniform tuberculid is given to this rash.

[ARCH. DERMAT. & SYPH.]

THE DIAGNOSTIC SERVICE OF THE WIENER ALLGEMEINE POLIKLINIK FOR TUBERCULOUS CHILDREN. K. PEYRER, Med. Klin. **21**:891, 1925.

The service has more than a thousand findings on its records. The children examined come from the dispensaries.

Roentgen-ray findings of a pleurisy or a primary focus are reliable, as they occur only in infected children. Mistakes are very rare. Roentgen-ray findings of a hylum lymph node enlargement and of an increase of the lung marking occur frequently in children who are not infected and are, therefore, not reliable.

For a reliable diagnosis in tuberculosis of children, repeated examinations are necessary and the subjects have to be viewed from many different aspects.

THE MÁTÉFY REACTION IN TUBERCULOSIS OF CHILDREN. K. DIETL and HELEN MASLOVSKI, Med. Klin. **21**:1163, 1925.

The authors have investigated the value of the Mátéfy reaction in a great number of cases of tuberculosis in children. The reaction is based on the relative increase of the globulin of the blood serum in diseases in which

there is a protein destruction. Their conclusions are: From a diagnostic point of view, the Mátéfy reaction helps to determine the activity of a clinically latent tuberculous process. From a prognostic point of view the gradual disappearance of the reaction indicates an improvement, the increase of it an impairment of the patient's condition.

ZENTAY, St. Louis.

PULMONARY TUBERCULOSIS WITH CAVITY FORMATION IN INFANTS. A. GHON, Ztschr. f. Tuberk. **43**:3, 1925.

Ghon analyzes 890 necropsies on children with tuberculosis; 203 of these were in the first year of life; of these, 191 had a primary pulmonary infection, sixty-five had definite cavities and twenty-four caseous foci tending to cavity formation. Ninety-one per cent of the cases with cavity showed hematogenous propagation of the tuberculous infection. Forty-five had only one cavity. The size of the cavities varied from the size of a pea to a cavity which extended almost throughout the whole right upper lobe of an infant 10 months of age. The cavities may either be the result of the primary focus (primary cavity) or they may arise from metastatic processes or from a superinfection (secondary cavity). The comparative frequency of the localization of the cavities is the same that Ghon has found in his material for the site of the primary focus; i. e., in order of frequency: right upper lobe, left upper lobe, left lower lobe. right lower robe, right middle lobe.

MAX PINNER, Chicago.

STUDIES OF THE MANTOUX REACTION AND OTHER TUBERCULIN TESTS IN CHILDREN. H. R. KROGSGAARD, Acta Pediat. **5**:103, 1925.

The author has compared the Pirquet test, the Moro test (inunction of a tuberculin ointment) and the Mantoux test (intradermal injection of 0.1 and 1.0 mg. tuberculin) in a large number of children. The Mantoux reaction is unquestionably more delicate than the other two, but is open to the objection that constitutional reactions are at times obtained. This test also gives a slightly greater percentage of false (traumatic) reactions.

The author recommends that the Pirquet and Moro reactions be tried first. If these are negative, the Mantoux test should be performed.

HYPOPLASIA OF THE MANDIBLE AS A CAUSE OF CHOKING FITS IN INFANTS. EINAR LENSTRUP, Acta Pediat. **5**:154, 1925.

The anomaly described is a congenital shortening of the mandible in its anteroposterior diameter, which permits the tongue to fall back and obstruct the passage of air into the larynx. There is a characteristic facial expression. Marked inspiratory dyspnea is present from birth, but can be relieved by placing the child on his face. The condition is outgrown in a few months.

HOLT, Baltimore.

THE OCCURRENCE OF THE TUBERCLE-BACILLUS IN SPINAL FLUID INVESTIGATED AFTER CULTURING ON PETROFF'S MEDIA. K. A. JENSEN, Ugesk. f. Læger **33**:710, 1925.

The technic of this method of culturing fluids on Petroff's media is given in brief. No attempt has yet been made to compare this method of culturing the tubercle bacillus with findings from guinea-pig inoculations.

A study was made of spinal fluids from twenty-two patients suffering with tuberculous meningitis. Fifteen of the spinal fluids gave a positive growth on the culture media; seven remained negative. The author remarks, however, that only one sample of spinal fluid was tried from each patient. Of the fifteen spinal fluids that were positive, in only one or two was it possible to demonstrate the tubercle bacilli microscopically. It is also pointed out that the time required for the culture method to become positive is shorter than that for the guinea-pig inoculation.

The author further makes mention of Bender's modification for the microscopic detection of tubercle bacilli. He believes that the use of equal parts of absolute alcohol and a watery picric acid solution is superior for counterstaining and gives a higher percentage of positive findings.

THE CHEMOTHERAPEUTIC VALUE OF SANOCRYSIN. KNUD FABER, Ugesk. f. Læger **44**:949, 1925.

This paper tabulates the results obtained with sanocrysin in forty-two patients treated by the author. Excellent results were evident in 60 per cent of those treated. A summary of the cases treated in the Danish sanatoriums, 274 patients, shows that good results have been obtained in 52 per cent of the cases.

It must, however, be considered that a year is a short time to advance any statistical data when dealing with a disease so treacherous as tuberculosis.

SCHLUTZ, Minneapolis.

OBSERVATION AND TREATMENT OF SYPHILIS IN CHILDREN. HESCHELES, Polish Pediat. **6**: (May and June) 1925.

These observations were collected in the dispensary for syphilitic children, connected with the children's clinic of the University of Lemberg, during the five years of its existence.

In the treatments there were used intramuscular and intravenous high doses of neo-arsphenamine, 0.15 Gm. during the first year of life, disregarding the child's weight and 0.30 Gm. in the second year when the child was over 10 Kg. in weight. Arsphenamine was combined with intramuscular injection of an emulsion of calomel in oil in amount of 1 mg. of mercury per kilogram of body weight daily. The results were encouraging. The mortality dropped from 80 to 15 per cent during the first years of life. The best results were obtained in children in whom the treatments started in the first three months of life. The author's observations showed that only 6.5 per cent of all children showed a slow intellectual development.

PIOTROWSKY, Mansfield, O.

Internal Diseases

CALCIFICATION IN THE HEART AND PERICARDIUM. ELLIOTT C. CUTLER and MERRILL C. SOSMAN, Am. J. Roentgenol. **12**:312 (Oct.) 1924.

Only seventeen cases of pericardial calcification have been reported as diagnosed antemortem. The three types of calcification found are endocardial, myocardial and pericardial. Rheumatic fever is the most common preceding disease, with tuberculosis, pneumonia and syphilis next in order. The deposition of lime salts occurs in the calcification of the pericardium itself following healed pericarditis; in both the pericardium and myocardium following infec-

tions specific for muscle, and in the region immediately underlying the larger valves following rheumatic fever. The presented plates show the different stages of calcification found both antemortem and postmortem. Some of these were confirmed at necropsy.

INVESTIGATION OF THYMUS STIMULATION BY ROENTGEN RAYS. MAURICE LENZ, Am. J. Roentgenol. **13**:226 (March) 1925.

After observing a large series of rabbits, the author does not support the theory that the hypofunctionating thymus can be stimulated by exposing it to roentgen rays in fractions of an erythema intensity. He proposes that the involution of the hypofunctionating human thymus progresses more rapidly after such an irradiation, and probably upsets the endocrine balance and liberates proteins previously kept in combination in the thymus parenchyma cells.

STULIK, Chicago.

UREMIA IN ACUTE GLOMERULAR NEPHRITIS. THE CAUSE AND TREATMENT IN CHILDREN. KENNETH D. BLACKFAN and BENGT HAMILTON, Boston M. & S. J. **193**:617 (Oct. 1) 1925.

Findings are based on study of eleven cases. Several cases are reported in detail to illustrate the course of the disease and the effect of the treatment; also necropsy findings in one case.

The conclusions of the authors are:

1. The form of uremia seen in acute glomerular nephritis in children is characterized by headache, vomiting, visual disturbances, delirium or coma, and convulsions.

2. It is always preceded by a steady rise in arterial tension and by visible but not necessarily marked edema. A steady increase of arterial tension is the most reliable indication of approaching uremia.

3. Intracranial tension resulting from edema of the brain is probably the causative factor of the symptoms in this form of uremia. This is suggested by finding an edematous brain at necropsy and the relief afforded by treatment favoring a decrease of cerebral edema.

4. Arterial hypertension is probably the result of increased intracranial pressure.

5. The intravenous injection of 1 per cent solution of magnesium sulphate, together with the administration of large doses of the salt by mouth and by rectum, has been found to be effective in the treatment of this form of uremia. The intravenous injection should be repeated if necessary at twelve to twenty-four hour intervals until the blood pressure remains at a low level and the cerebral symptoms have subsided.

6. Intravenous treatment is not effective during the medullary cone phase or in the terminal stages.

7. Lumbar puncture should be used guardedly in order to avoid incarceration of an edematous brain in the foramen magnum.

8. The term uremia is misleading, as the symptoms are not dependent on the retention of nitrogenous end-products. It is suggested that the characteristic symptoms with arterial hypertension be referred to as the cerebral symptoms of acute glomerular nephritis.

The treatment should not be given except in the presence of cerebral symptoms, as it apparently does not alter the course of the disease as evidenced by the renal symptoms.

According to the authors, a 2 per cent solution of the crystallized salt makes a solution of about 1 per cent magnesium sulphate. It is injected intravenously into one arm while the blood pressure is taken on other arm; from 10 to 20 cc. per kilogram of body weight at the rate of 2 cc. to not more than 10 cc. per minute.

The fall in blood pressure during the procedure is the best index as to the total amount necessary to use.

Frequently diaphoresis and diuresis follow, but when injected intravenously magnesium sulphate does not exert a cathartic action. The authors also advise from 1 to 1½ ounces of the 50 per cent solution by mouth every four to six hours, and from 2 to 3 ounces per rectum every six hours.

The injection is repeated on reappearance of cerebral symptoms and hypertension. Urinary retention or evidence of renal irritation have not followed the use of the solution.

GENGENBACH, Denver.

PROTEIN SHOCK IN THE TREATMENT OF RHEUMATOID ARTHRITIS. J. CRUICKSHANK, M. J. & Rec. **121**:621 (May 20) 1925.

By the injection of certain foreign substances, especially proteins, either intramuscularly or intravenously, a marked physiologic reaction known as protein shock is obtained. Because this protein shock reaction increases the activity of certain parts of the defensive mechanism of the body, it has been used as a means of increasing nonspecific immunity in the treatment of infection of obscure origin such as rheumatoid arthritis. The clinical value of the treatment is discussed and it is believed, although still in the experimental stage, protein shock therapy has certain value in rheumatoid arthritis, accelerating clinical improvements, but this special treatment should be carried out in conjunction with other therapeutic measures. The technic of protein shock therapy is given in detail in the paper.

THE COURSE OF RHEUMATIC HEART DISEASE. CAREY F. COOMBS, M. J. & Rec. **121**:623 (May 20) 1925.

The onset of rheumatic heart disease dates nearly always from childhood or adolescence, the commonest age period being from 5 to 15 years. It may first be noticed under one of four groups of circumstances. 1. When it is first discovered by the physician attending a choreic patient. 2. When he is examining the anemic underweight child. 3. When examining the patient showing signs of cardiac inefficiency. 4. During an examination at an insurance office. The heart may either be attacked by an overwhelming dose of poison and the child may die in a few days with acute dilatation or the subject may have small attacks over a long period of time and not until adult life will any signs of inefficiency be detected. The pathologic change in the auricular wall is a degenerative one. The ventricular muscle shows lesions of an active infection which is more hurtful to cardiac inefficiency than any other factor. Experience has taught us that the hope of abolishing this disease, like that of cerebrospinal meningitis, is chiefly by prevention directed by a clearer and more accurate knowledge of the causal micro-organisms.

ARTHRITIS AN INFECTION OF THE DIGESTIVE TRACT. A. MUTCH, M. J. & Rec. **121**:625 (May 20) 1925.

In this article, the author reports a series of cases to show arthritis is often caused from infection in the lower zones of the alimentary tract. Patients will continue to suffer from arthritis after extraction of all their teeth and when they are devoid of tonsillar tissue. Infection from the bowel may be either localized or diffuse, involving the whole intestinal tract. The commonest organism in this series was found to be streptococcus. Generally, there is some morbid condition underlying these infections, such as: 1. Stagnation. 2. Ptosis. 3. Defective ferment action. 4. Gastric ulcer or gallstones. The treatment followed in this series of cases was as follows: The entire alimentary tract was surveyed carefully, the more accessible areas of infection in the jaws, throat, and intestines treated surgically. Autogenous vaccine supplemented these measures. Any patients showing a dysfunctioning gland were given thyroid extract with great benefit to the joints.

PYLORIC OBSTRUCTION IN INFANTS WITH A NERVOUS HEREDITY. ROBERT L. PITFIELD, M. J. & Rec. **122**:148 (Aug. 5) 1925.

Little is known about the etiology of pyloric stenosis in infants. The condition is ascribed by some to hypersuprarenalism. Feer states that pyloric disease in infants is a neurosis dependent on a neuropathic ancestry. In the author's ten cases, all the patients had one neurotic parent and four of the patients had athletic fathers. Athleticism is a form of hypersuprarenalism, according to some writers. From the study of these cases, it seems the condition of pyloric stenosis may be due to an hereditary nervous imbalance.

ANEMIA PSEUDOLEUKEMIA INFANTUM (VON JAKSCH). SAMUEL A. BLAUNER, M. J. & Rec. **122**:157 (Aug. 5) 1925.

This disease was given the first clear clinical description by Von Jaksch in 1889. It is an anemia peculiar to early infancy, showing itself between the third and sixth months. The book picture is that of a secondary anemia, with blood destruction and blood regeneration. The author reports the case of a child, aged 7 months. On admission to hospital the child was acutely ill, passing tarry stools and with only 16 per cent of hemoglobin. A transfusion was given immediately, and within three hours the hemoglobin was up to 40 per cent. Three days later it was 45 per cent. At the end of two weeks hemoglobin was 62 per cent. The interesting feature of this case was the spontaneous cure following transfusion, the child leaving hospital after two weeks both physically and clinically well.

WILLIAMSON, New Orleans.

LIPODYSTROPHIA. VINCENT COATES, Brit. J. Child. Dis. **22**:194 (July-Sept.) 1925.

The author defines lipodystrophia as a disease especially liable to affect children from 5 to 8 years of age, in which, characteristically, there is loss of subcutaneous fat of the face, neck, thorax, arms and abdomen, without assignable cause or gross symptoms of ill health. In association with this there is in addition in females an increase of subcutaneous fat below the iliac crests.

The course of the disease can be divided into the active stage, lasting on an average from 2 to 3 years, during which the disease is progressive, and the final or stationary stage in which there remains a permanent cosmetic disability.

The author reports two new cases in boys of 7½ and 7¾ years of age.

LANGMANN, New York.

DISCUSSION ON THE PITUITARY. Tr. M. Chir. Soc., Edinburgh, M. J. **32**:201-224 (Nov.) 1925.

Sir Edward Schaefer described the morphology, development and structure of the gland. In the discussion which followed, Prof. John Fraser stated that at the Children's Hospital "pituitary lakes" of colloidal fluid had been found in the center of the gland, which had some connection with the control of growth. An interesting experiment with tadpoles demonstrated that when they were placed in a thyroid solution their movements were active, while those which lived in an extract of anterior pituitary lobe became huge and slow in movement. Fraser spoke of a girl, aged 8 years, who had for years a suprasellar tumor and polyuria controlled by injection of pituitary extract.

Professor Bramwell mentioned a case of diabetes insipidus in which the excessive thirst and the polyuria were immediately relieved and remained so for twenty-four to thirty hours following one dose of 1 c.c. of pituitary extract. He thinks there is a possible relationship between hypopituitarism and muscular dystrophy. He is observing a boy, aged 11 years, who has typical pseudo-hypertrophic dystrophy and also adiposity with poor development of the genitals. He has seen a number of patients with both diabetes insipidus and adiposogenital dystrophy.

NEFF, Kansas City, Mo.

INFANTILE ASTHMA. L. MORQUIO, Arch. Españ. de Pediat. **9**:513, 1925.

In discussing asthma, this eminent South American clinician concludes it is a constitutional and distinctly hereditary disease. It is commonly seen in the so-called arthritic type of child.

All asthmatic children are sensitive to atmospheric changes, such as temperature, effect of winds, etc. Many of them have hypertrophy of the nasopharyngeal ring. Adenoids are generally present and hypertrophy of the tonsils. This predisposes to all kinds of infection and congestion of the upper respiratory tract.

The author believes that alimentary factors and food only occasionally play a rôle as causative factors. He believes, also, that there exists absolutely no connection between asthma and tuberculosis. Certain specific factors and influences seem to operate as causative factors in asthma.

Under the head of treatment, the author discusses general hygienic and prophylactic measures. Certain respiratory gymnastics are advocated. The complete removal of hypertrophied tonsils and adenoids is generally indicated. As a preventive, the author recommends the use of potassium iodid internally, in amount varying between 35 and 50 gm. a day. This is alternated for given periods with some glandular extract, preferably pancreatic. This is recommended on the theory that there is some relationship between asthma and some not yet well defined alteration in internal secretion.

The nervous system plays a prominent rôle in the symptomatology of asthma. Suggestive therapy and educational therapy often are very helpful in the treatment.

The treatment of the actual attack varies with the intensity of it and the presence of much respiratory difficulty. Tincture of aconite and tincture of belladonna in equal parts and epinephrin given by mouth or subcutaneously, are favorite remedies of the author.

Report of a Case of Erythromelalgia. Juan Carlos Navarro and Bernardo E. Sas, Arch. Españ. de Pediat. **9**:521, 1925.

The authors report a case of this rare condition, first described and named by Weir Mitchel in 1878.

The disease is characterized by the appearance of vaso dilatation in the distal parts of the body, especially the extremities, and the manifestation of pain in the affected parts. This sometimes reaches such degree that the patient is in a constant torment. Heat intensifies the pain while cold ameliorates it. The lesions generally are symmetrical. The condition is very chronic and subject to many remissions and exacerbations.

The patient, an Argentine boy, aged 7 years, had had definite symptoms of the disease for about three years before admission to the clinic. The symptoms were worse during the summer and abated considerably during the winter. Only the soles of the feet were affected. Except for a slightly positive Wassermann reaction, all laboratory findings were negative. Keeping the feet practically constantly in cold water was the only measure which gave some relief. Intensive antisyphilitic treatment was without effect. The patient developed intestinal hemorrhages and died.

Only a few cases of this disease have been reported in children.

Concerning Bone Formation in a Tumor of the Hypophysial Stalk. M. Meyer, Beitr. z. path. Anat. u. z. allg. Path. **73**:518, 1925.

An epithelial hypophysial duct tumor in a 12 year old girl was associated with calcification of the epithelial tissue and with true bone formation in the surrounding fibrous tissue. Meyer concludes that the tumor was not a teratoma.

Schultz, Chicago.

Contribution to the Study (zur Kasuistik) of Mediastinal Tumors. R. Böhmig, Frankfurt. Ztschr. f. Path. **33**:80, 1925.

This is a case history, with the report of a mediastinal teratoma, occurring in a youth, aged 17, written from the standpoint of the pathologist. The tumor weighed 5,570 gm. occupied the anterior mediastinum, displacing the heart and right lung to the right and compressing the left lung until it was quite flattened and atelectatic. The neoplasm was brightly mottled and contained many cavities and lobules from the size of cherry stones to hens' eggs. The grayish-white stroma contained numerous sinuses and chinks filled with clotted blood and communicating with large vessels. Microscopic examination revealed an abundance of cavities, some lined with single layers of cuboidal, some with cylindric epithelium. Another type of sinus showed an endothelial lining overlying the epithelial; while a third type had no lining whatsoever. The tumor was composed of variable connective tissue stroma and overgrowth; extensive necrotic areas and lymphocytic infiltrations; large cystic gland cavities lined with cuboidal or cylindric epithelium and filled with a gelatinoid substance; cartilage showing hyalin and degenerative changes; innumerable tiny to large blood sinuses (the larger the size of half an egg); and very few small blood vessels. The German literature on the subject of mediastinal teratoma is then discussed at some length.

Foot, Cincinnati.

CONCERNING THE PALE YELLOW COLOR OF THE SKIN IN THE PYURIAS OF INFANCY. W. LASCH, M. FISCHER and M. SILBER, Monatschr. f. Kinderh. **31**:164, 1925.

This is a quantitative confirmation of the clinical observations of Finkelstein and others, that the color of the skin in some of the pyurias of infancy is due to a mild degree of jaundice. The observers determined that in some cases the blood contains per hundred cubic centimeters as much as 4.6 mg. of bilirubin. The amount of bilirubin, however, cannot be used as an index of the prognosis.

GERSTLEY, Chicago.

MILIARY NECROSIS OF LIVER IN INFANTS. L. SCHWARTZ, Virchows Arch. f. path. Anat. **254**:203, 1925.

Schwartz studied three instances of liver necrosis observed at necropsy. He holds that it is erroneous to refer to them as the result of pseudotuberculosis. This name had been used because of their resemblance to similar lesions in the lower animals. The changes did not show the slightest resemblance microscopically or histologically to true tubercles. Schwartz regards miliary necrosis as an entity, as an infectious process having its origin in some birth incident and manifesting itself in the first few days of life. Premature infants and twins seem particularly susceptible. The bacteria found were of the diphtheroid type.

[ARCH. OF PATH.]

MIDBRAIN IN DIABETES INSIPIDUS. H. KIYONO, Virchows Arch. f. path. Anat. **257**:477, 1925.

In a case of diabetes insipidus Kiyono found marked round cell infiltration in the tuber cinereum. The posterior lobe of the hypophysis was atrophic, this change being considered secondary to the alterations in the nuclei of the tuber cinereum and neighboring midbrain ganglion.

SCHULTZ, Chicago.

A CASE OF ENDOPHLEBITIS HEPATICA OBLITERANS. ERIK BÖTTIGER, Acta Pediat. **5**:144, 1925.

The condition described is an obliterating thrombo-angitis confined to the hepatic vein and its branches. The symptoms were an enlarged liver with ascites, but no jaundice. Most of the cases have occurred in adults. The author's patient was 3 years old. The etiology is obscure.

HOLT, Baltimore.

TREATMENT OF CHRONIC ARTICULAR RHEUMATISM IN CHILDREN, WITH SULPHUR. H. FRENKEL, Polish Pediat. **6**:139 (May and June) 1925.

The method, originally French, was introduced into Germany in 1921 by Meyer Bich. The author gave intramuscular injections of sulphur in severe cases of chronic articular rheumatism, in which salicylate, thermotherapy and milk injections had been insufficient. The dosage of sulphur used was 0.5 to 1 cc. in oil and eucalyptol. Usually from 3 to 6 injections were sufficient. Occasionally, 13 injections have been used. Sixty per cent of patients showed complete recovery, 40 per cent showed marked improvement.

PIOTROWSKY, Mansfield, O.

Nervous Diseases

A Roentgenographic Study of the Sella Turcica in Abnormal Children. M. P. Gordon and A. L. Loomis-Bell, Endocrinology **9**:265 (July-Aug.) 1925.

Studies were made of the contours of the sella turcica in sixty-four abnormal children. The findings were compared with those of 104 normal children. It was found that the shape of the sella does not differ significantly in normal and abnormal children. The type of disorder is not correlated with the shape of the sella. Round and oval shapes predominate both in abnormal and normal children and flat sellas are the least frequent.

The formation of the sella does not differ in abnormal children from that in normal children. There is no formation characteristic of any individual disease. The excavation that has been described in mongolian idiots is extrasellar. It may be uncovered or covered by the lesser wings of the sphenoid. It is a normal formation found with the same frequency in all children and is not characteristic of any known disorder.

The size of the sella is not influenced by any of the diseases studied. As in normal series, there was found no relationship between the size of the sella and the size of the head nor between the shape of the sella and the size of the head.

W. W. Waddell, Jr., University, Va.

Gentian Violet Intravenously in Chorea and Encephalitis. John W. Visher, J. Nerv. & Ment. Dis. **62**:376-380 (Oct.) 1925.

The author reports four cases, three of typhoid encephalitis and one of chorea. In these cases gentian violet was administered intravenously to the patients when they were growing progressively worse. He states that recovery began from a few to thirty-six hours. Dosage ranged from 2 to 5 mg. per kilogram of body weight. The author feels that, since there are reports of gentian violet being nonbactericidal in vitro, its use should not be discarded in vivo, as it acts in conjunction with body fluids and tissues.

A New Etiologic Factor in the Production of Some Cases of Hydrocephalus. A. S. Maclaire, J. Nerv. & Ment. Dis. **62**:498-503 (Nov.) 1925.

The author offers new evidence of a possible etiologic factor in the production of an internal or communicating hydrocephalus. He believes that intracranial birth hemorrhage — often overlooked because of lack of symptoms — may organize or produce adhesions, and at times obstruct the pathway of the cerebrospinal fluid, producing a hydrocephalus. To support his views, he offers a case report in which an infant suffered an intracranial hemorrhage at birth, the blood being demonstrable in the spinal fluid. Eight months later patient began to develop hydrocephalus. Withdrawal of spinal fluid, which was under 20 mm. of mercury pressure, gave temporary depression of fontanel. A diagnosis of obstructive, communicating hydrocephalus was made, based on the history and examination. An argument is given against this condition being present or caused prenatally.

Preceding the main topic, a brief review is given concerning the etiology by other authors.

Floyd, Iowa City.

CEREBRAL DEGENERATION IN AN INFANT. NORAH H. SCHUSTER, Brit. J. Child. Dis. **22**:206 (July-Sept.) 1925.

The author refers to the report of Paterson and Carmichael in 1924 of the necropsy findings in two infants of the same family. These showed a degenerative condition of the basal ganglions and caudate nucleus, disappearance of the nerve cells from these regions, excessive production of neuroglia and fibrous tissue and great capillary proliferation.

The author's patient, an infant, who died at the age of 6 months, showed very similar lesions of the brain. She suggests the possibility of its being associated with the hepatolenticular degeneration described by Wilson.

LANGMANN, New York.

CEREBRAL HEMORRHAGE WITH GLYCOSURIA IN A CHILD. DOROTHY G. E. POTTER and AGNES R. MACGREGOR, Edinburgh M. J. **32**:482 (Sept.) 1925.

Spontaneous cerebral hemorrhage in a boy, aged 5 years, who had previously been well, appeared suddenly, with loss of consciousness, fever of 102 F., cerebral tache, positive Babinski sign, convulsive movements and spasticity of the extremities. The spinal fluid was under increased pressure and contained blood. Sugar and acetone were found in the urine. The child lived only thirteen hours. Examination of the brain showed extensive hemorrhages in the pons and medulla and in the fourth ventricle, the floor of which was ruptured, probably the cause of the glycosuria. The complete necropsy gave no explanation for the brain hemorrhage, as embolism and hemorrhagic disease were absent.

NEFF, Kansas City, Mo.

THE SPINAL FLUID SUGAR IN ENCEPHALITIS. JAMES L. HALLIDAY, Quart. J. Med. **18**:300, 1925.

This work was undertaken as a critical test of the assertions frequently made in recent years that in cases of encephalitis there is an increase in the sugar content of the spinal fluid, which serves as a useful aid in the diagnosis of encephalitis. The conclusions reached in this well executed piece of work are: 1. That food intake may have an important influence on the spinal fluid sugar, a fact not considered by other workers. 2. That the spinal fluid sugar in all cases was within normal limits when the spinal fluid was obtained after a twelve hour fast. 3. That if the relation of spinal fluid sugar to blood sugar is considered, it is found that the percentage ratio lies between the limits of 49 and 70, which are also the normal limits.

JOSEPHS, Baltimore.

THE USE OF MAGNESIUM SULPHATE IN THE TREATMENT OF TETANY. A. EMMANUELE, Pediatria **32**:631, 1925.

Emmanuele reports 16 cases of tetany in which magnesium sulphate was used. He states that favorable results were obtained, very often the attacks or convulsions ceasing after the first injection; also the electrical reactions became normal very often after the first injection. Laryngospasm was the most resistant to this mode of treatment. Emmanuele gives from 1 to 3 c.c. of a 25 per cent. solution of magnesium sulphate subcutaneously, repeating the injection every other day until the symptoms are under control. The infants so treated tolerated the drug very well, no skin reactions nor systemic disturbances being

noted in any of the cases. The author concludes that magnesium sulphate given subcutaneously as described is an efficient method in the treatment of all forms of infantile tetany.

DE SANCTIS, New York.

ON THE EFFECTS OF RADIOTHERAPY IN TUMORS OF THE CENTRAL NERVOUS SYSTEM. G. ARTOM and M. BOLAFFIO, Riv. Oto-neuro-oftal. **1**:43 (March-June) 1924.

The authors present two cases of cord tumor and thirteen cases of brain tumor of varying localization and nature which were submitted to roentgenotherapy. Except in a few instances when the maximal dose with short intervals was given, applications consisted of a half dose each time, three half doses in all, with intervals of seven days. Among the phenomena observed immediately after the irradiations, the authors report one death (gumma of the right temporal lobe) in a patient who received a full dose, and had the usual symptoms of headache, vomiting, tachycardia and tachypnea. They observed also slight hyperthermia in a few cases, hiccough in one case, herpes zoster in one case and psychic symptoms in a little girl.

The results obtained in the two cases of cord tumor (glioma and gliosis) seem to indicate that there was some remission and retardation of the course; two cases, however, are too few to warrant definite conclusions. Regarding the brain tumors, the authors state that roentgen irradiations are useful in cases of pituitary tumor with acromegaly. Retardation of the course, remission and improvement of the headache, the hypersomnia, the asthenia of vision and of the sexual disorders may be obtained. In cases of extrapituitary tumors, the roentgen irradiations cannot modify the outcome of the disease, but in many cases they produce improvement of the general symptoms, especially of the headache and vomiting. The influence on local symptoms is less evident, and is essentially limited to the cerebellar symptoms. Roentgen therapy is consequently indicated for patients with severe headache and vomiting, and for those presenting preeminently cerebellar symptoms.

The authors then discuss the choice between radiotherapy and other therapeutic procedures (decompression, extirpation of the tumor, etc.); they conclude that the inaccessibility of many tumors and the poor results from surgery still demand the use of palliative measures. Important considerations militate against decompression and in favor of radiotherapy in many cases; this method should be tried not only in cases in which the tumor in inoperable, but also in those that are operable. There is only one exception, the cortical or immediately subcortical tumors of the rolandic zone; these tumors present the most favorable conditions for radical treatment and the most unfavorable conditions for radiotherapy.

NACCARATI, New York.

REPORT OF A FEW CASES OF SYDENHAM'S CHOREA CURED BY INTRAVENOUS INJECTION OF NEO-ARSPHENAMIN. LUIS HERRERA, Arch. Españ. de Pediat. **9**:527, 1925.

The author is impressed with the favorable results brought about in several patients with chorea by the intravenous injection of neo-arsphenamin. He believes this treatment to be particularly efficacious in the syphilitic subject affected with chorea, but is under the impression that it is equally useful in the nonsyphilitic subject with chorea.

SCHLUTZ, Minneapolis.

EPILEPSY OF GENITAL ORIGIN. JOHANN SUSMANN GALANT, Monatschr. f. Kinderh. **31**:117, 1925.

This case, reported from Russia, scarcely belongs in a pediatric journal. It concerns a woman, aged 23, who was living somewhat unhappily with her husband. One year after the birth of her second child the menses returned. Each month, with the onset of the period, she would suffer an epileptic attack. The author goes into considerable detail in describing all the symptoms of the seizure. It seemed to be quite typical of the true disease. The author puts this case in the group of hysteroepilepsy, a condition described by a number of neurologists.

GERSTLEY, Chicago.

THE PATHOGENESIS OF PHOSPHATE TETANY. K. O. AF KLERCKER and MARTIN ODIN, Acta Pediat. **5**:79, 1925.

Studies of the blood chemistry and the electrical irritability were made in children after administration of sodium phosphate, acid sodium phosphate and potassium dihydrogen phosphate. Both the primary and secondary phosphate increased the electrical irritability, lowered the calcium and raised the inorganic phosphorus of the serum. When latent tetany was already present, phosphate administration produced active tetany. A single experiment with potassium dihydrogen phosphate showed an increase in electrical irritability all out of proportion to the drop in calcium. The observations confirm those made on dogs by Salvesen, Hastings, and McIntosh. The conclusion reached is that tetany produced by sodium phosphates is due to a lowering of the calcium. In the case of potassium phosphates, the direct irritating action of the potassium ion may play a part. No constant relation was found between the increase in the phosphorus and the reduction of the calcium. The mechanism of the calcium reduction is not clear.

CONTRIBUTIONS ON SPASMOPHILIA. III. IS THERE A SPASMOPHILIC PSEUDOPERTUSSIS? W. WERNSTEDT, Acta Pediat. **5**:126, 1925.

A study of the electrical reactions in coughs of all kinds indicates that with increased electrical excitability there is a tendency for the cough to become spasmodic. In pronounced cases with typical electrical reactions of tetany, the cough at times could not be distinguished from that of pertussis. There were reasons for believing that pertussis was not present.

HOLT, Baltimore.

Diseases of the Eye

OCULAR MANIFESTATIONS IN SERUM SICKNESS. A. L. BROWN, Am. J. Ophth. 8:614 (Aug.) 1925.

This is a report of ophthalmoscopic examinations in seventy-five patients who developed serum sickness after intravenous injections of diphtheria antitoxin. Ocular manifestations noted were moderate to severe hyperemia with or without serous exudate into the surrounding tissue causing papilledema in 20 per cent of the cases. Vascular dilatation was observed within fifteen minutes of an injection. In fifteen of the cases urticarial reactions were present, and in these cases it was observed that the ocular manifestations varied directly in intensity with the urticaria, and developed with the onset of the urticaria in the same manner as previously noted, subsiding with a subsidence of the urticaria. Epinephrin had a temporary inhibitory effect on the ocular reactions in these cases.

FOERSTER, Milwaukee.

Diseases of the Ear, Nose and Throat

TONSILLECTOMY AND ADENOIDECTOMY IN SELECTED CASES DURING THE PERIODS OF PRIMARY AND SECONDARY INFECTIONS. FREDERICK T. CLARK, Ann. Otol., Rhinol. & Laryngol. **34**:491, 1925.

This procedure is considered by the author to be entirely rational and conservative. It is recommended in certain types of acute angina, with threatening or developed atypical peritonsillar abscess and marked glandular involvement. Especially in cases of acute otitis media in which there are pathologic tonsils and adenoids present, their prompt removal is advocated as one of the first considerations, both to cure the otitis and to abort a surgical mastoiditis. That infected tonsils and adenoids in children are responsible for a large percentage of the cases of bronchitis and bronchopneumonia, as well as sinus infections, coughs and colds, is a well established fact, and in all such cases the removal of the tonsils and adenoids is recommended. The operation should also be considered in suspected or present juvenile tuberculosis. In view of the inference that the tonsils and adenoids are the chief foci of infection in scarlet fever, diphtheria and measles, it is only logical that their removal be practiced not only as a prophylactic measure but as a rational means of shortening contagion during acute attacks in selected cases, and to prevent the frequent otitic and nephritic sequelae. In unaccounted for hematuria, albuminuria, acute nephritis or pyelonephritis, the tonsils and adenoids should be suspected as the focus of infection, and if not above suspicion, prompt tonsilloadenoidectomy should be done to prevent structural changes in the kidneys

The author reports a series of successfully operated cases, and he firmly believes that such a surgical procedure, in selected subjects, is not attended by grave dangers to the patient but is a procedure of value to both the patient and the surgeon.

SNAPP, Grand Rapids, Mich.

A YEAR OF ENDOSCOPY. LYMAN RICHARDS, Boston M. & S. J. **193**:761 (Oct. 22) 1925.

Most of the subjects were children, and included the following groups: laryngoscopic, bronchoscopic, esophagoscopic and cardiospasm. In the laryngoscopic group there were four young infants with laryngeal stridor in whom "there was an apparent redundancy of the mucous membrane covering the arytenoids to such an extent that the glottic lumen was encroached on and simulated the wearing of an over large coat." Also the following cases: a boy, aged 6 years, had hoarseness for two months; examination showed chronic laryngitis and small membranous patch negative for diphtheria; a boy, aged 3 years, showing marked inspiratory dyspnea and substernal retraction, revealed "whole laryngeal lumen narrowed down just like a funnel toward the trachea;" a boy, aged 4½ years, with gradual development of a laryngeal stricture over a period of two years; a boy, aged 18 months, removal of "small piece of white material like a macerated corn shuck," tracheotomy became necessary, development of subcutaneous emphysema from the neck all over the body, and death.

Bronchoscopic Group: a girl, aged 3 years, had been ill for fifteen months. examination revealed metallic wood screw in the right bronchus, pyopneumothorax and lung abscess. The patient died despite removal of screw and thoracotomy; two cases of peanut kernels in bronchus; a case of laryngotracheobronchitis in which "apparently the accumulation of tenacious mucopus in the lower bronchi acts as a complete obstruction"; the patient, aged 2 years,

died; another similar subject, aged 18 months, with less severe infection recovered; a group of eight patients treated for some form of chronic lung suppuration, had repeated bronchoscopic aspirations which were usually helpful; a girl, aged 2¾ years, had pressure on trachea and main stem bronchi due to a mediastinal tuberculosis.

Esophagoscopic group included foreign body cases (coins and pins), and esophageal stricture due to accidental swallowing of caustic or lye.

Two cases of cardiospasm in young adults are also reported.

GENGENBACH, Denver.

TWO UNUSUAL CASES OF CHOLESTEATOMA OF THE MIDDLE EAR. GINO MERELLI, Arch. ital. d. otol., rinol e laringol. **36**:491-500, 1925.

Merelli reports in detail two cases. In one, he was surprised to discover an unsuspected cholesteatoma at operation. There had been no chronic purulent otorrhea immediately preceding, and the morbid process appeared in its symptom complex to point to an acute type of disease, with no indications of anything other than an ordinary acute mastoiditis. In the second case, a girl aged 8, presented a bilateral cholesteatoma, the infection having spread from one ear to the other. The infection of the left ear was not evidenced by otorrhea, the tympanic membrane being intact, although the infection had undergone slow development.

THE MASTICATORY FUNCTION AND THE DEVELOPMENT OF THE NASAL CAVITY. CORRADO D'ALISE, Arch. ital d. oto., rinol. e laringol. **36**:501-506, 1925.

D'Alise recalls that, from time immemorial, the mouth and the nose have been treated as if there were nothing in common between them. This is a grave error, and has contributed much to the delay in recognizing the harmonic unity of the body as a whole, not only anatomically but also physiopathologically and clinically. The author emphasizes that in paired organs, in order to secure a normal and symmetric development, an equally intense functional activity is required in each organ (or in the two sides of an organ); for example, for the proper development of the nasal cavity and the face there must be normal and efficient mastication on both sides, which is possible only when the masticatory function of the temporary and the permanent teeth is preserved intact. In children, if mastication is suppressed, on one side or on both, for even a few days, the injurious habit of chewing only on one side or of masticating the food insufficiently will be acquired, with the inevitable result that an asymmetrical or defective development of the face will ensue.

WOLCOTT, Chicago.

ANGINA WITH LYMPHATIC REACTION. KURT NELKEN, Monatschr. f. Kinderh. **31**:151, 1925.

The author reports the case of a boy, aged 4 years, who was taken acutely ill with sore throat, fever, and adenopathy. For eight days a papular exanthem was also present, particularly on the extremities. The blood picture, with 58,000 leukocytes of which 56 per cent were lymphocytes, was very suggestive of leukemia. A section of superficial lymph node gave a histologic picture of leukemia also. In a few weeks, however, the whole symptomatology had disappeared and another section of a lymph node gave a normal picture.

Cases of this type have been described by Deussing and by Turk.

GERSTLEY, Chicago.

CISTERNA DRAINAGE IN THE THERAPY OF OTOGENIC MENINGITIS. M. GOERKE, Ztschr. f. Hals-, Nasen-u. Ohrenh. **12**:144 (Nov.) 1925.

The author advises drainage of the cisterna pontis lateralis. He proceeds by uncovering widely the dura of the posterior and middle fossae (following the usual radical mastoid operation) which are joined by removing the angle of the pyramid. This gives better access to the field. He also uncovers the posterior fossa behind the sinus and downward as far as the lower knee thereof for the same purpose. He then removes the petrosa as far the labyrinth capsule (Bogengang massif; posterior canal prominence). The dura is then elevated with a septum elevator along the angle of the pyramid as far as the internal auditory meatus, and downward to the bulbus jugularis. A 1 cm. incision is made in the dura between the meatus and the apertura interna, which lies 8 mm. deeper. This is followed by a profuse gush of liquor, and a gauze drain is quickly inserted. If a labyrinth operation is indicated, the cisterna is located with greater certainty by following the usual labyrinth operation through to the meatus.

He states that this procedure is rational as it follows the route of the infection, gives free and persistent drainage, without danger of brain prolapse, and an opportunity to discover the route of the infection, and associated pathology, such as sinus phlebitis or cerebellar abscess, if present.

He has operated on five patients, with two recoveries, and alleviation of the symptoms of the others (cultures of the spinal fluid are not reported). He credits Bárány with the first description of the cisterna lateralis complex, and Holmgren and Uffenorde with priority in cisterna drainage operation from which his is adapted.

THE DIAGNOSTIC SIGNIFICANCE OF CISTERNA PUNCTURE, ALSO THE COMBINED CISTERNA AND LUMBAR PUNCTURE. ZANGE and KINDLER, Ztschr. f. Hals-, Nasen-u. Ohrenh. **12**:150 (Nov.) 1925.

This procedure is advocated for the determination and location of subarachnoid block, in which case pressure on the jugularis causes no rise in the pressure of spinal fluid either at the cisterna or lumbar regions. If it fails to rise only in the lumbar region, the block is spinal. Air pressure fluctuating the fluid between the two levels, or staining solution flowing through also indicate absence of spinal block. The cisterna puncture is considered preferable for diagnostic purposes of intracranial conditions, as it is nearer the pathology, and shows changes earlier.

Cerebral block occurs from exudates or tumor pressure closing the foramen Magendie or Luschká's foramina, interfering with ventriculocisterna communication. Increased intracranial pressure is exerted in all directions, and only when fluid is removed from the cisterna magna and spinal sac faster than it can flow in again from the ventricles, are cranial contents forced into the foramen magnum. This may not always be an immediate result, but may occur gradually as the result of progressive block of the ventriculosubarachnoid communications brought about by lesser displacements of cranial contents resulting from withdrawal of small amounts of liquor. Authors advise in case of suspicion of block, for instance finding a solider mass instead of liquor or little fluid after the needle is felt to go through the atlanto-occipital ligament, that physiologic sodium chlorid solution be used to replace the lost fluid. Authors suggest also the possibility of removing through a larger needle some cranial contents for biopsy. Authors also report one case of cisterna block, in which the pulse pressure fluctuations usually seen in spinal puncture, were

absent, and several cases in which the cytologic and chemical changes in the spinal fluid were misleading because of lack of communication with the source of the trouble.

Finally one of them (Kindler) reports the recent discovery by him of the failure of one sided jugular pressure to increase the spinal fluid pressure in case of thrombosis of that jugular, evidently unaware of the work of Tobey and Ayer (*Archives of Otolaryngology* **2**:50 [July] 1925).

BACTERIOLOGY OF OTOGENIC MENINGITIS. H. NEUMANN, Ztschr. f. Hals-, Nasen-u. Ohrenh. **12**:165, 1925.

The author reports 119 cases, of which fifty-four were acute and forty-eight chronic suppurative otitis media. One hundred and one of the meningitis cases were monobacillary, eighteen polybacillary, of which only one followed acute ear trouble. Of the seventeen polybacillary cases which followed chronic ear suppuration, fifteen had more than one intracranial complication, as did thirty-four of the chronic with monobacillary infection and sixteen of the acute.

Of the monobacillary the principal offenders were: *Streptococcus pyogenes,* forty-five times; *Streptococcus mucosus,* twenty-two times; *Diplococcus pneumoniae,* sixteen times; *Staphylococcus pyogenes,* four times; *Obligatory anaerobe,* three times. Diplostreptococcus and *Streptococcus lanceolatus,* two each; gram-positive cocci, gram-negative cocci, coli commune, pyocyaneous, 1 each.

Neumann believes that complications occur only during acute exacerbations, and reports the case of a patient with discharge from the ears in which two neurologists had diagnosed temporal lobe abscess and on whom he refused to operate because of absence of acute symptoms in the ear. The patient made a good recovery.

This author believes bacterial differentiation will prove valuable in the serologic treatment of meningitis, which he thinks is our best hope for the future.

LEWY, Chicago.

Diseases of the Skin

THE TREATMENT OF ANGIOMAS IN INFANCY AND EARLY CHILDHOOD. STAFFORD MCLEAN and A. BENSON CANNON, Internat. Clin. **3**:40, 1925.

"Strawberry marks," noted at birth, light red, not raised above the surface, most frequently found in the suboccipital region and at the base of the nose between the eyes, usually disappear before the end of the first year. If they persist after puberty, and are in a conspicuous location, they may be removed by superficial desiccation with the electric needle.

Spider nævi occur most frequently on the cheeks or nose, are light or deep red, have a slightly raised center, from pin point to millet seed in size, with fine threadlike blood vessels radiating in all directions. They may result from trauma, and often disappear before the third year. If persistent, they may be removed by puncturing the center with an electric needle.

Port wine marks are most difficult to treat. Roentgen ray, radium and carbon dioxid snow are of little or no value. Treatment with the Kromayer lamp may lessen the redness, but few patients are cured. The authors treated three cases with desiccation, removing the nævi but leaving a smooth white atrophy.

Circumscribed, raised, discrete angiomas never disappear without treatment. All increase in size with body growth, sometimes rapidly. Infection with sloughing and hemorrhage may occur. Treatment should begin early, but

usually not before the fourth month of life. If located over the anterior fontanel, removal should not be attempted until closure has taken place on account of the danger of injury or infection of underlying parts. Removal is best accomplished by carbon dioxid snow, though radium has been successfully used.

Angiomas situated at the mucocutaneous junctions, most commonly about the anus and vagina, if superficial, have a tendency to disappear, but when raised above the surface, may become annoying on account of hemorrhage or infection. Treatment is with carbon dioxid snow.

The treatment of large, infiltrating, cavernous angiomas may be by radium, surgery, endothermy or carbon dioxid snow, according to the indications in the individual case.

SMITH, Ogden, Utah.

DIFFUSE (GIANT) NEVI REMOVED FROM AN EIGHT-YEAR OLD GIRL. JAMES W. DAWSON, Edinburgh M. J. **32**:605 (Oct.) 1925.

The entire October number of this journal is devoted to a study and discussion of the morphology and histogenesis of the melanomas. One of the subdivisions is that of diffuse or giant nevi. The writer reports the clinical and histologic findings in a child whose right forearm and hand had been disfigured since birth with a diffuse, black, hairy mole. As the child grew the size of the mole increased. At about 7 years of age an operation was performed by Mr. J. J. M. Shaw, and was of extreme interest. The affected skin was dissected from the forearm and back of the hand. The arm was then drawn through a subcutaneous tunnel in the girl's abdominal wall, and allowed to remain and grow there for three weeks. The abdominal skin was next incised and wrapped around the remaining denuded areas of the arm. After the arm had been taken away from the abdominal wall, the latter was repaired by skin grafts.

The writer describes the structure of the affected skin which is characterized by diffuse patches on the upper corium filled with a solid cell mass, and the intervening spaces of the epidermis are thin and pigmented. The pigmented areas are partly covered with nodular and warty projections, similar in structure to a hyperkeratosis. The deeper layers are not invaded by nevus cells or pigment.

THE EFFECT OF ANTISCARLATINAL SERUM IN A CASE OF ERYTHEMA NODOSUM. G. H. PERCIVAL, Edinburgh M. J. **32**:763 (Nov.) 1925.

Nine days following a doubtful case of scarlet fever in a young child, erythema nodosum appeared on the legs and arms. Into the skin overlying one of the nodules, 0.3 c.c. of scarlatinal antistreptococcus serum was injected, followed in seventeen hours by a typical Schultz-Charlton blanching which remained for six days.

Although erythema nodosum is rarely reported in scarlet fever, the writer quotes authors who believe that the disease is due to streptococcic infection. The blanching phenomenon in this case supports the contention of Lendon that the condition is an acute specific fever, which in this instance was probably scarlet fever.

NEFF, Kansas City, Mo.

A Review of the Literature on Skin and Infectious Diseases During 1924. Karl Leiner, Monatschr. f. Kinderh. **31**:97, 1925.

This is a fifteen page review of all the literature appearing during 1924 on the subject of skin and contagious disease. While here and there one interested in one particular subject might find something of interest, as a whole, little work of any real significance has been done.

Gerstley, Chicago.

Surgery and Orthopedics

Renal Ureteral and Urethral Calculi. S. Wollenstein, M. J. & Rec. **122**:152 (Aug. 5) 1925.

The author reports a case of renal, ureteral and urethral stone, necessitating an external urethrotomy, suprapubic cystotomy and nephrectomy. These operations were performed about one month apart. The patient made an uneventful recovery. Pyuria is too often diagnosed as pyelitis when it is due to calculus. In all cases of pyuria a cystoscopic examination should be made, this being no more difficult or dangerous for a child than for an adult. An early diagnosis of stone made by a thorough urologic examination permits a conservative operation being performed, whereas delay means sacrifice of the kidney. Graded operations are often indicated in multiple and bilateral calculi.

Williamson, New Orleans.

A Case of Intraperitoneal Abscess of Unknown Origin, Probably Pneumococcal. C. P. R. Gibson, Brit. J. Child. Dis. **22**:41, 1925.

A girl, aged 6½ years, was admitted with a six days' history of epigastric pain and profuse green diarrhea, no vomiting. The temperature was 102.4 F., the pulse 126 and respiration 40.

For three days after admission diarrhea persisted and vomiting occurred once or twice a day. The respirations went up to 60 and the pulse to 140. The temperature ranged between 100 and 103 F. The right side of the chest was explored but nothing was found. During the second week, a mass was felt just to the right of the umbilicus. Then generalized dulness of the abdomen with fluid thrill developed. An abscess pointed internal to the left anterior superior spine. On incision, this yielded foul smelling gas and pus.

The child died two months after admission and necropsy revealed a large abscess filling the true pelvis. The appendix was healthy and not connected with the abscess cavity. The right lung was congested and friable and showed some consolidation.

Langmann, New York.

Changes in the Blood in Anesthesia. Dorothy G. E. Potter, Quart. J. Med. **18**:261, 1925.

A study was made of the alkaline reserve, blood sugar and blood phosphate before and shortly after short periods of chloroform and ether anesthesia. It was found in conformation with the observation of others that the fall in alkaline reserve occurred in the first few minutes of anesthesia. The inorganic phosphorus content of the blood usually rose following anesthesia, as did also the blood sugar, but there was no constant relationship in the extent of the rise of these two constituents. It is suggested that the increase in blood phosphate is due to the passage from the muscles to the blood of hexose phosphoric acid.

Josephs, Baltimore.

Miscellaneous

INTRATHORACIC CHANGES INDUCED BY HEAVY RADIATION. WILLIAM A. EVANS and T. LEUCUTIA, Am. J. Roentgenol. **13**:203 (March) 1925.

Infiltration or fibrosis of the lungs and pleura may occur following a single large dose, or multiple small doses. First, a hyperemia develops and this is followed by an edematous infiltration. If the blood vessels are injured, this is replaced by fibroplastic proliferation instead of being reabsorbed as is usually the case. Greatest damage, even death, is produced by a massive second dose given before the resorption of the first infiltration. The treatment of the changes is purely symptomatic. Adequate technic is the best prophylactic.

ABDOMINAL DEEP THERAPY INJURIES WITH REPORT OF NECROPSY FINDING IN A FATAL CASE. CLARENCE F. BALL, Am. J. Roentgenol. **13**:220 (March) 1925.

Macroscopic destruction of mucosa and extensive hemorrhagic changes in the bowel are reported. Care should be used to prevent injury to the bowel by alteration of position during long treatments, and pituitary extract should be used before treatment. Adjustment must be made for injurious accumulative secondary rays set up by the promontory of the sacrum to the overlying tissues. Postoperative prophylactic short wave roentgen therapy is analogous to an elective operation, and similar "check up" precautions are as imperative as before the major operation.

STULIK, Chicago.

CERTAIN ASPECTS OF FOCAL INFECTION COMMONLY MISUNDERSTOOD. HERMON C. BUMPUS, JR., M. J. & Rec. **119**:333 (April 2) 1924.

The author emphasizes in a general way certain practical applications of the relation that focal infection bears to clinical cases. Removal of the tonsils is not sufficient and infected teeth must also be considered as portals of entry. Partial removal of foci will not bring even partial relief of symptoms. Only complete removal can hope to accomplish this; the most painstaking care must be exercised in order that no tonsil remnants remain. One case is given, showing the effect of focal infection and pyelonephritis.

BYFIELD, Chicago.

THE NEED OF THE PRESCHOOL AGE CLINIC FOR THE PRESCHOOL CHILD. T. HOFFA, Gsndhstfürs. f. d. Kindesalter **1**:53, 1925.

The social, hygienic and behavior problems of the preschool child are evident in the condition of the child who is starting to go to school. Every school physician and teacher knows that the situation is almost hopeless. A complete and well planned health supervision for the preschool child is, no doubt, necessary for the welfare of the land.

Ten per cent. of the children were considered unfit for school in 1910, 30 per cent. were considered only partially fit. The situation is worse since the War. Social service workers, church, school, physician and hygienist must work together if anything is to be accomplished.

Scientific problems regarding growth and development of the child and nursling, his metabolism and nutritional needs can be followed through in such a preschool clinic. Practical problems which will take a most comprehensive view of the preschool child, can also be worked out. This can only be accom-

plished by public clinics in which there are both stations for consultation with the physician and home visits by the nurses.

Lack of time on the part of the mothers, lack of clothing for the children and carelessness on the part of the parents interfere with the progress of this work. This will be overcome only by home visits, giving advice while children are being publicly fed, while they are being vaccinated and given toxin-antitoxin. These preschool clinics could also be used for the bodily and spiritual development of those children who are ready for school, according to their age, but not according to their bodily or mental progress. Arrangements could also be made for children who are difficult to train or are psychopathic.

EHRMANN, Chicago.

THE BIOLOGICAL REACTIONS AFTER NONSPECIFIC SERUM INJECTIONS IN EARLIEST INFANCY. B. EPSTEIN and F. HELLER, Med. Klin. **21**:884, 1925.

In the first trimenon, the symptoms of hypersensibility after nonspecific serum injections are slightly less frequent than in later infancy and in older childhood (33, 44 to 50 and 46 per cent respectively).

The serum reactions are evenly distributed over the first three months of life.

If the usual precautions are neglected, one may see also in the first trimenon very severe reactions of the type of anaphylactic shocks after the injection of foreign protein. These reactions will not occur in daily injections of small doses due to the antianaphylaxis developed by this method.

The intensity of the serum reactions in infants of the first 3 months of age does not differ from that in older children.

Premature infants show the same hypersensibility as mature ones.

ZENTAY, St. Louis.

PROCEEDINGS OF THE FIFTY-THIRD CONGRESS OF THE GERMAN PEDIATRICS SOCETY, INNSBRUCK, 1924, Monatschr. f. Kinderh. **29**:289-668, 1925.

The proceedings consist of over sixty different articles, most of them presented as abstracts and appearing in full in other journals. Almost one half of the space is devoted to a symposium on tuberculosis with special reference to the use of tuberculin. Much of it is highly technical and only of interest to specialists in this subject. There are a number of abstracts, however, which merit a brief review.

THE BRESLAU SCHOOL CHILDREN. S. SAMELSON, Monatschr. f. Kinderh. **31**:44, 1925.

By means of weight and height charts and measurements, the writer attempts to determine whether the War had any influence on the future development of the children who were born during that period. His findings are not altogether definite and not quite convincing, as he himself admits, for even before the War, the nutrition of the German school children was not considered satisfactory. The lack of definite prewar statistics makes any conclusion inaccurate. The War, however did seem to increase the amount of rickets and tuberculosis.

GERSTLEY, Chicago.

Society Transactions

ST. LOUIS PEDIATRIC SOCIETY

Regular Meeting, Oct. 16, 1925

GEORGE M. TUTTLE, M.D., *President*

RECENT STATISTICS FROM THE ST. LOUIS ISOLATION HOSPITAL. Presented by DR. CURTIS LOHR.

Of nineteen cases of suspected epidemic cerebrospinal meningitis, twelve proved to be meningitis of other types. A number of patients admitted with a tentative diagnosis of scarlatina were reactions following arsphenamin. A number of patients with dermatitis medicamentosa were sent to the hospital with the mistaken diagnosis of erysipelas. The cross infection rate in the hospital was 7.65 per cent. in 1923-1924, and only 1.8 per cent. in 1924-1925.

A CASE OF "PINK DISEASE." Presented by DR. JOHN ZAHORSKY.

The patient was an infant, German descent, aged 16 months. The mother nursed the baby for 15 months. At the age of 12 months a fine papular rash appeared on the body, and the hands and feet became reddened. Since that time the child has not been well, and has been quite cross and irritable. Later, the phalanges of both hands and feet began to swell and a furunculosis developed on the body. Ultimately there was gangrene of one toe. Recently, three lower incisors loosened and fell out. At the age of 14 months the white blood cells were 28,000; red blood cells, 6,000,000. In spite of good feeding the general condition of the child showed no improvement, but a few treatments by the quartz light seemed to initiate a change for the better. At the time of writing, the child was definitely improved. The mouth was healing and the gangrenous part of the toe had separated, leaving a good granulating surface.

RECENT WORK ON THE CYTOLOGY OF THE DIARRHEAL STOOL. Presented by DR. JOHN ZAHORSKY.

The author mentioned his three previous papers on the microscopic examination of diarrheal stools. It is of importance to note both the number and kind of cells present. The large cells (lymphoid cells) are easily recognized. These are probably macrophages (clasmatocytes). Regular polymorphonuclear cells and lymphocytes can easily be differentiated from the macrophages in the unstained specimens. The cells are not readily stained. Alkalimethylene blue and eosin is the most satisfactory stain to use. The presence of giant cells, ghost cells and polymorphonuclear cells point to true infectious enteritis, while mononuclear cells in excess, and especially when associated with eosinophils, indicate allergic enteritis. The findings of Haughwout, and others in the Philippines, in cases of dysentery are applicable to the enteritis of infants.

INFANTILE DIARRHEA IN ST. LOUIS DURING THE SUMMER OF 1925.. Presented by DR. JOHN ZAHORSKY.

An especially severe form of infantile diarrhea occurred during the summer of 1925. The total mortality from diarrheal diseases in infants in St. Louis during the last summer has been more than double that of the preceding

three years. The unusually hot weather may have contributed to the high mortality, but the essential cause seemed to be a greater virulence of the intestinal poison. Young infants repeatedly passed into the severe state of alimentary intoxication. Nothing seemed to have a curative effect. Subcutaneous and intraperitoneal injections of Ringer's solution were of only temporary benefit. This would tend to disprove the assumption that alimentary intoxication is a true anhydremia. Some poison must be present which prevents the tissues from absorbing water. The work of Plantenga is of interest in this connection. He demonstrated experimentally that the toxins of the colon bacillus could produce all the symptoms of alimentary intoxication in calves within a few hours' time, and before much fluid was lost from the body. An antitoxic serum to combat this disease must be sought for.

DISCUSSION

DR. MCKIM MARRIOTT: I agree that the epidemic of diarrhea among infants during the summer of 1925 was especially severe. These diarrheas were not the result of parenteral infection, nor of enteral infection with the dysentery bacillus. The condition failed to respond to methods of treatment which ordinarily are successful. Many of these patients were made worse if milk in any form was administered, and it was necessary to feed them nothing but carbohydrate for a number of days. There seemed to be some evidence that the infecting organism in the intestinal tract was one which elaborated its toxins principally from protein. Sclerema was present in a fair proportion of the severe cases of diarrhea.

A CASE OF OVARIAN CYST WITH TWISTED PEDICLE, SIMULATING APPENDICITIS. Presented by DR. G. LIPPMANN.

A girl, aged 11 years, had suffered from repeated attacks simulating appendicitis. At operation, a large ovarian cyst with twisted pedicle was removed.

CENTRAL STATES PEDIATRIC SOCIETY

First Session

Chicago, Nov. 6, 1925

MAURICE BLATT, M.D., *in the Chair*

HISTOPATHOLOGIC CHANGES IN AMAUROTIC FAMILY IDIOCY (TAY-SACHS TYPE). Presented by DR. G. B. HASSIN.

Amaurotic family idiocy is one of the few central nerve disorders that possesses a fairly specific pathology. The changes in the central nervous system are considered so typical that a diagnosis is possible under the microscope. Histopathologic studies may, in addition, throw some light on the nature of the disease process, whether amaurotic family idiocy is a congenital anomaly, a degeneration or an inflammation.

Stained by whatever method, the ganglion cells invariably appear altered, the cell body is swollen, balloon shaped or bottle shaped, the dendrites are tumefied and often missing, the nucleus is misplaced toward the apical dendron,

and the fibrils in specimens stained with silver nitrate, according to the method of Bielschowsky, gathered at the periphery. Anilin staining methods show a wealth of chromophilic substance (Nissl bodies) gathered around the nucleus and absent in the remaining portion of the cell body. This, when stained with hematoxylin, shows numerous granules classified as prelipoid substances. One portion of the ganglion cells thus appears fully developed, the other degenerated, or in a state of aplasia. Such cells are scattered throughout the entire central nervous system, in the cortical areas, basal ganglions, midbrain, pons, medulla and the spinal cord, the motor and sensory ganglion cells being affected alike. Many of these maldeveloped or incompletely developed ganglion cells ultimately become entirely degenerated, causing secondary nerve degeneration with reactive glia phenomena and accumulation of lipoids. Especially is this the case with the optic thalami, the larger portions of which are transformed in a scar of glia tissue, with poverty of nerve fibers and accumulation of vast amounts of fatty substances within the ganglion cells, perivascular and subarachnoid spaces. Inflammatory phenomena are absent throughout. Instead, there is a widespread maldevelopment of the ganglion cells, which is the principal feature of amaurotic family idiocy. Maldeveloped as the ganglion cells may be, they are compatible with life, for they have been found in other types of amaurotic idiocy, such as late infantile, juvenile and in adults. When the maldeveloped cells become degenerated, life is impossible. Degenerated ganglion cells are more or less present throughout the entire central nervous system, but are especially abundant in the optic thalami. Here the parenchymatous changes are most extensive and intensive, and one is justified in concluding that the degeneration of the optic thalami is another pathologic feature of the type of amaurotic family idiocy known as the Tay-Sachs type.

MULTIPLE SKELETAL TUBERCULOSIS AND KÖHLER'S DISEASE OF THE TARSAL NAVICULAR BONE. Presented by DR. D. B. PHEMISTER.

The following case of skeletal tuberculosis is of interest because of the unusual extent of involvement of the shafts of several long bones, and because of the bearing which it has on the etiology of an associated Köhler's disease of the left tarsal navicular bone. A child, aged 4 years, entered the Presbyterian Hospital because of swelling of the shafts of several of the long bones. The trouble started a year previously with gradual enlargement of the submaxillary lymphatic glands, which broke through the skin after six months, leaving discharging sinuses. The mother noticed swelling along the shafts of the left tibia and of the second left metacarpal bone for two months. On examination, the submaxillary lymph glands were considerably enlarged and a discharging sinus from which watery and cheesy material could be expressed was present on each side. On skeletal examination, there was diffuse enlargement effecting about 4 inches of the lower end of the shaft of each humerus and the upper end of the shaft of each ulna. There was a spindle shaped enlargement of the middle 4 inches of the shaft of the left tibia, and of the entire shaft of the second left metacarpal bone. These swellings were slightly tender, but there was no evidence of suppuration around them. There was slight elevation of temperature in the afternoon. Roentgenograms of the bones in the involved region showed spindle shaped periosteal thickening, with extensive irregular cortical absorption, but absence of sequestrums or cavities. A roentgenogram taken incidentally of the left foot showed reduction in size, irregularity and increased density of the shadow cast by the center of ossification of the left navicular bone. It was the roentgen-ray picture ordinarily

seen in Köhler's disease. Examination of the region showed absence of swelling or tenderness around the scaphoid. Blood Wassermann tests were negative, and the leukocytes were found normal in numbers. A tentative diagnosis was made of tuberculous lymphadenitis and multiple skeletal tuberculosis. Tissue was excised from a submaxillary lymph gland, from the swelling of the tibia and from the involved center of ossification in the navicular bone. Microscopically, the typical picture of tuberculosis was found in the tissue excised from the lymph gland and from the tibia. The navicular bone was normal in appearance until the center of ossification was incised. From it, necrotic bony material devoid of granulation tissue was removed with a curet. Microscopically, the tissue consisted mainly of necrotic bone and white fibrous connective tissue, which in places was absorbing the dead bone. There were no infiltrative cells. There was almost no living bone and normal bone marrow. Guinea-pig inoculations with material from the scaphoid bone were negative for tuberculosis.

The question arises as to whether the lesion in the scaphoid bone was produced by the tuberculous process. The fact that they coexisted makes it highly probable. Axhausen has claimed that necrosis in the centers of ossification of growing bones is the result of embolism from tuberculous débris which contains so few or mildly virulent tubercle bacilli, that the typical inflammatory picture of tuberculosis does not result. The findings in this case would tend to support that view.

BANANA THERAPY IN CELIAC DISEASE. Presented by DR. H. E. IRISH.

When this patient was 4 years old, she weighed 19 pounds and 7 ounces, and her appearance was that of a child of 1½ years. She was 31 inches tall, with the chest measurement of a child aged 1 year, and the head measurement of a child aged 18 months. Her history was the usual one of this disease. She was in good health until she was 9 months old, when attempts were made to wean her. She refused milk, but took various things given her by various physicians, and at 2 years of age had an attack of what was probably tetany, associated with dietetic conditions. She has almost doubled her weight in the last year, and now weighs 32 pounds.

She was put on the usual high protein diet, with skimmed buttermilk as the main basis, supplemented later with other proteins. In October of last year we instituted the banana treatment. This had to be discontinued during an attack of grip but was started again on her recovery. The bananas have always been finely divided by putting them through a potato ricer, and there has been an effort to secure ripe bananas. We started with 1 tablespoonful and gradually increased the amount until she now takes three whole bananas a day, in addition to the protein diet. Haas refers to giving as many as sixteen bananas a day to a child, aged 2 years. This child took them eagerly and improvement began at once.

Another patient had been on a protein diet, with four to six stools a day, without any material gain, for two months. She has shown a gain of 12 to 14 ounces a week since we instituted the banana therapy.

The final value of the banana treatment will not be established until larger series of cases of celiac disease are treated by this method.

HEAD INJURIES IN CHILDREN. Presented by DR. KARL A. MEYER.

In the usual discussion of head injuries, we find the subject divided into injuries of the vault and injuries of the base. However, in necropsies our findings in a great majority of cases show that when the injury of the vault

occurs, there is also an injury of the base. Injuries of the skull bear little relationship to surgery. It is the injury to the brain and its covering from which surgical intervention arises. These patients must be watched closely, and an early diagnosis made for the proper institution of surgical treatment. This is especially true in children.

The first symptoms shown are those of cerebral concussion. During this time the patient should be placed in a prone position, plenty of external heat applied and intravenous injections given to raise the blood pressure. No spinal puncture should be attempted at this time. In a variable time the child may come out of the concussion phenomena and have but few symptoms; other subjects may develop evidences of irritative or of compression phenomena. This may come on in a few hours, or a week or more may elapse. At this time the surgeon, pediatrician and neurologist should have a thorough understanding of the pathology. No operation should be undertaken without definite indication.

The compression phenomena is diagnosed by a definite slowing of the pulse, slowing of the respiration, increase in the blood pressure and increase in the pressure of the cerebrospinal fluid.

Spinal pressure should be taken regardless of the age of the child. If the spinal pressure registers over 10 mm. of mercury, multiple spinal punctures are indicated, the number and time depending on the amount of compression shown by the spinal manometer. In these acute brain injuries of children, we have never encountered any dangerous symptoms following this procedure.

In patients in whom multiple spinal punctures have not relieved the compression and a beginning papilledema is present, a Cushing decompression may be done. This may prove to be a life saving measure in a certain percentage of cases. It is our policy to operate when depressed fractures are present in infants and children. I also operate when compound linear fractures are present.

In cases of definite middle meningeal hemorrhage or suspected subdural hemorrhage, an early operation should always be performed. One must also remember that these patients must be operated on when in good physical condition, and not late in the compression stage. Mortality at this time should deter one from operation.

OSTEOMYELITIS. Presented by DR. W. R. CUBBINS.

I wish to emphasize the necessity for early diagnosis and early operation on osteomyelitis of a fulminating type. Osteomyelitis can be classed as:

1. Acute suppurative osteomyelitis, to which I would add the term "fulminating." This may involve a joint, but joint involvement is rare.

2. A type, of less violence.

3. Brodie's abscess.

4. This is called albuminous periostitis, but in reality it involves the cortex and some of the medulla.

Of these types, the most important is the first. It has not been difficult for me to separate acute osteomyelitis from arthritis, because it has been my experience that the point of tenderness will determine accurately the point at which the bone has been and is being attacked. If you do not see a patient until the condition has spread into the joint, it is obvious that a differentiation is impossible. A child, starting out with pain, localized near a joint in a limb, with high temperature and a high leukocyte count, and a definite point of tender-

ness on the shaft of a bone, near the end or near a joint, should be immediately operated on. No possible harm can come in the case of an incorrect diagnosis, which will be rare; much good can result in the case of a correct diagnosis, and a long period of disability and a serious illness can be avoided.

Contrary to what is generally believed, the marrow has quite a resistance to infection and, if the cortex is removed, allowing the pus to escape at an early period, it will be found that the abscess is primarily localized and does not involve the entire shaft. If no pus should be discovered at this point, the attack on the bone will not add any danger to the child's life or limb. And, if the operation has been done under aseptic conditions, the recovery will be rapid and leave no defect.

It has not been our fortune to have an acute suppurative osteomyelitis localized in one portion of the bone in those patients who enter the hospital. But it has been our fortune to see about ten or eleven foci develop in other bones, as a sequence to an acute primary osteomyelitis; and the early incision and drainage of these metastatic osteomyelites has always served to give us a prompt and uneventful recovery in that bone. This, of course, providing that the general sepsis involving the other organs does not result fatally.

As regards removal of sequestrums when there has been a fulminating type of osteomyelitis, that has been neglected until the entire shaft has become involved with a sequestrum of greater or less extent, of late it has been our custom to remove this necrotic bone with as little trauma to the involucrum as is possible. No effort has been made at curetting away the granulation tissues or of making the irregular surfaces even, and the results have been startling; they have been so excellent that I have begun to question the necessity of extensive operations, such as have been recommended for the flattening of the bone. In my patients, these cavities have been filled up and obliterated just as soon as the last necrotic spicule was extruded. One must remember that, irrespective of how clean we may chisel a bone, how even and smooth it may look following an operation in a septic field, there will always be a subsequent necrosis of the superficial layers; and that, while some of this necrotic bone may be completely destroyed, there will always remain other fragments which have to be extruded, even after the most radical operation.

DEMONSTRATION OF FRESH NECROPSY SPECIMENS. Presented by DR. H. A. SINGER and DR. J. GREENGARD.

DR. SINGER: In the past few days necropsies have been performed on two cases of tuberculosis, and the fresh organs have been saved to be demonstrated at this meeting. Dr. Greengard, the resident on the pediatric service, will give the main features of the clinical history.

DR. GREENGARD: The first patient, a child, aged 8 months, was admitted to the ward for contagious diseases on Oct. 29, 1925, with a diagnosis made by the Health Department of epidemic meningitis. This child died November 2. The child became suddenly ill three weeks previous to admittance, with a high temperature and marked stupor lasting for about one week. Following this initial lethargic stage, the child improved but was very irritable for about ten days and just prior to admittance a convulsive seizure occurred. At the hospital for contagious diseases a diagnosis of tuberculous meningitis was made on the findings of meningeal irritation, a clear spinal fluid with increased globulin and 340 lymphocytes, though epidemic encephalitis was also considered

on the basis of the history. The patient was then transferred to the children's hospital, where a final diagnosis of tuberculous meningitis and generalized miliary tuberculosis was made.

DR. SINGER: Here in the lower lobe of the right lung there is an area of tuberculous bronchopneumonia, presumably the primary focus. The tissues here have undergone a caseous necrosis. The lower bronchial lymph glands into which the lymphatics from the region of the primary focus drained, are enlarged and caseous. Softening has occurred both in the bronchopneumonic focus and in a peribronchial lymph gland, with a resultant miliary spread from one or the other of these sites. The meningeal involvement has led to this very marked internal hydrocephalus, in addition to the usual exudative and proliferative changes at the base.

It is of interest that the patient was extremely lethargic at the onset of the illness, for it is highly probably that a marked degree of hydrocephalus was present at that time, the meningeal involvement being then only slight but sufficient to interfere with the free circulation of the cerebrospinal fluid. Progression of the meningeal process at the base led to irritative phenomena followed by a terminal paralytic and comatose stage, as the hydrocephalus became aggravated.

DR. GREENGARD: The second case is that of a colored child, aged 20 months, who was admitted to the Children's Hospital, Oct. 18, 1925, with a diagnosis of lobar pneumonia, and who died November 4. On examination, consolidation of the left lower lobe of the lung was found to be present and the condition was thought to be a left lower lobar pneumonia. The child continued to run a highly febrile course with marked exacerbations in the evening. On November 2, findings of fluid in the left side of the chest were noted, and the liver and spleen were found to have become definitely palpable. We thought at this time that we were dealing with a purulent pleural effusion, but upon exploratory thoracentesis a sero-sanguinous fluid was obtained, with few cells, most of which were lymphocytes. The child continued to lose ground and finally died, our final conclusion being an infiltrative tuberculosis of the lower lobe of the left lung with a generalized miliary distribution.

DR. SINGER: As you see in this specimen, the lower lobe of the left lung is entirely consolidated, and at the necropsy occupied the entire left side of the chest, totally compressing the upper lobe which is atelectatic. The involvement of the left lung represents a caseous pneumonia not quite uniform, being a confluent lobular pneumonia rather than a true lobar phthisis. The cause for this diffuse spread was readily disclosed, for on opening the bronchus to the left lower lobe, a perforation of its wall by a softened caseous peribronchial gland was found. In addition, there is a generalized miliary dissemination.

The genesis of the process is apparently as follows: The primary focus, presumably in the left lower lobe, led to caseous involvement of the hilum glands, one of which perforated into a bronchus resulting in a tuberculous bronchopneumonia. In addition, entrance into the general circulation through the lymphatic or vascular system led to a miliary propagation. There is found, therefore, in this case the two common complications of a pulmonary tuberculous process which lead to a fatal outcome, the previous case being an illustration of death due to a miliary dissemination, unassociated with a bronchopneumonic spread.

An interesting necropsy specimen was seen, showing a tooth lodged in the third division of the left bronchus. The tooth evidently was loosened by trauma during a tonsillectomy and aspirated into the lung. This roentgenogram, taken

during life, shows a dense shadow which was identified by Dr. Blatt as a tooth and a correct diagnosis of resulting lung abscess made antemortem.

CONGENITAL CYANOSIS. Presented by DR. J. H. HESS.

At the first meeting of this Society, ten years ago, I showed these three brothers, all of whom have congenital cyanosis. The oldest is now 20 years of age and is a bank clerk. The second boy is 18, and the youngest is 16 years old. They have all developed well but retain the hue which we describe as "ghastly green," not the typical hue of congenital heart disease. The discoloration occurs over the body, and the hair more or less matches the hue of the skin. We took distance plates and found that they all had enlarged hearts, the right side of the heart and the pulmonary arch being most involved. There were no murmurs but the second pulmonic was accentuated. The systolic pressure was low and the pulse pressure was markedly so. The hemoglobin was examined by the spectrophotometric method, which showed a normal oxyhemoglobin. There was no increased fragility in the red cells. The blood shows no abnormal pigmentation, the red cells show no degeneration, the white cells are about normal and the Wassermann reaction and urinalysis are negative. We tested the volume flow of blood and found it a little above the average. We looked for changes in the chemical content but found none. The youths inspired about 20 per cent more air per minute; however, the expired air contained 25 per cent less carbon dioxid then the normal controls. We thought if we could measure the carbon dioxid in the venous and compare it with the arterial blood we might find something. The venous blood cannot be examined directly, but by a method which was suggested by Christiansen, Douglas and Haldane we can estimate the tension of carbon dioxid in the venous blood. You are all familiar with the method of Haldane for estimating the tension of calcium dioxid in arterial blood. Comparing the two, we found that some of the blood was not aerated, meaning that some of it must have reached the left ventricle without passing through the pulmonary circulation.

We believe that we have a congenital heart condition, with probably open ductus arteriosus in all three of these boys, and that only part of the blood goes through the pulmonary circulation. They all have an increased hemoglobin and this in all probability acts in a compensatory manner, so that the amount of carbon dioxid excreted by their lungs is kept within normal limits by the greater difference in the effectual diffusion pressure of carbon dioxid between arterial and venous blood in the lungs. Mentally the boys, are normal.

Cretinism Secondary to Removal of Displaced Telangiectatic Goiter.—A boy, aged 13 years, is in good condition at present. He apparently was normal at birth, but when 2 months of age developed a small tumor in the right parotid region. It grew to the size of his head and at 11 months was resected. Prior to that time he was an active, normal infant. The growth was a telangioma of the displaced thyroid and this was removed at operation. He became a cretin but this condition was not recognized for two or three years. He was then put on desiccated thyroid gland extract, and later on thyroxin, which he has taken practically all the time since. He is now getting 1/160 grain of thyroxin a day, and previous to that he got 1 grain of desiccated thyroid gland extract three times a day. He is a good, obedient boy, with a mentality of about 7 years.

Cretinism. Exophthalmic Goiter in Parents.—This girl's father first showed an exophthalmic goiter before the mother's pregnancy, but was not operated on

until six weeks after the child was born. (Recently, we have observed a cretin whose mother was operated on during pregnancy for an exophthalmic goiter.) This patient was brought in when she was 20 months of age and the diagnosis was very easy. There was no palpable evidence of thyroid. At 4 years she developed a small kernel in the region of the isthmus of the thyroid, which continued to enlarge. She was given thyroid extract continuously until the family moved to St. Louis, when the treatment was interrupted and the child developed a typical myxedema. She was brought back and the mother promised to be faithful in the treatment. The little mass continued to grow, and as it has grown she has been able to get along with less thyroid. She is now 12 years old, and while she was absolutely not of sound mind when we first saw her, she is now in the sixth grade and last year had an average of over 90 in all of her studies except arithmetic. She reads much of the time and is a good student. She did not start to school until she was almost 8 years old. The thyroid gland is now the size of a large egg, very soft and has the feeling of cystic degeneration. While not meeting her full requirements, she is making good progress with greatly reduced thyroid administration.

HEART DISEASE IN CHICAGO. Presented by DR. BLATT.

To the pediatrician, heart disease presents a problem similar to that presented by tuberculosis twenty years ago. It is a disease to be prevented in infancy and in childhood. We must make an effort to remove this crippling factor.

Of the drafted men during the World War, 120,000, or 5 per cent, were rejected because of heart disease. It is probable that the largest percentage of these young adults acquired their disability before puberty or shortly afterward.

Our work in Chicago is organized as follows: We have a special society for the prevention of heart disease; we have three or four special clinics for children where only those with cardiac trouble are taken, and several clinics where both children and adults with this disease are cared for. Many of the institutions still run their pediatric and heart clinics together. At Cook County Hospital, when children with heart disease are discharged from the ward, they become wards of the social service department of the University of Illinois. They are sent to convalescent homes and to camps for those with cardiac disease. They attend special schools, of which we have two particularly good ones. These are largely ground floor schools, or have inclines instead of stairs. The children are collected by buses and taken to school, have a rest period at noon and are taken home in the afternoon.

As part of our prophylactic work, at the Illinois Charitable Eye and Ear Clinic, twenty tonsillectomies are performed each morning. About the same number are done here, and in private hospitals large numbers are performed daily. This work has been going on for fifteen years, but in spite of it, the deaths in Illinois last year from heart disease numbered 12,000 in people of all ages. This far surpasses the tuberculosis rate, which at one time was ahead of all others, and I think we, as pediatricians, should make every effort to overcome it. (Series of charts were presented at this time.)

Cases 1 and 2. These two boys are old friends. The first one has been in the hospital thirteen times with re-infection or decompensation. He has a double mitral lesion. He is 12 years old, is in school every day, and I think we can give him sufficient education to make him self-supporting.

The second boy has been particularly interesting because he came under observation first when he was about 2 years old, and was examined by a number of physicians in the child welfare department at the University of Illinois. There was nothing in any way suggestive of a congenital heart lesion. At 3 years of age he had an acute febrile attack lasting for one day, with convulsions, during which he became quite cyanotic. Since then, he had had repeated attacks of cyanosis, and examination of the heart at the time of his convulsion showed a loud bruit over the base, which has persisted ever since. We have wondered whether this condition, and the same in several others that we have seen could not be classified as "latent congenital lesions." So far as the murmur and symptoms are concerned, they are certainly latent. We present the roentgenogram of a similar case, although the findings are somewhat different. The child is 3½ years old, and showed no cyanosis at birth, nor any evidence of heart lesion. At 2 weeks of age a mitral lesion appeared, without febrile disturbance. This represents to me possibly the same type of disease, a latent lesion which did not designate itself in any way at birth.

TUBERCULOUS ANAL FISTULAS. Presented by DR. A. H. PARMELEE.

This infant, a Mexican, aged 10½ months, was admitted to the Presbyterian Hospital three months ago with the complaint that he had sores around the anus and pain when the bowels moved. Ten days after his birth the mother noticed sores about the anus which became swollen, red and painful. Salves were applied, but the sores continued to grow until they became the size of a split pea. Two fresh ones were noticed when the baby was 6 months old. He was the sixth child; there had been no miscarriages. The first three children are living and well; the fourth child died at nine days of an umbilical infection and the fifth died at 10 months of pneumonia. The father aged 45, is living and well. His blood Wassermann reaction is negative. The mother is 40 years old, and is at present a patient in the Presbyterian Hospital. She has tuberculous lesions of several bones, with chronic discharging sinuses and mild diabetes mellitus. When the child was admitted to the hospital he was fairly well nourished but had moderately severe rickets. The spleen was not palpable; there were no palpable epitrochlear glands nor other evidence of general lymphadenopathy. No rash or scars were seen on the skin, and further examination revealed no abnormal findings except the condition around the anus. There were five condylomatous lesions near the anal orifice, two on one side and three on the other. They were pinkish, gray, raised, flat on top and moist and seemed to have a short, thick peduncle. They were cauterized and became very much smaller, but again increased in size and were cauterized a second time. Shortly after the second cauterization, it was noted that where the condylomatous masses had been, tiny openings from which minute drops of pus could be expressed were seen. One month ago, Dr. V. C. David examined the child under gas anesthesia and found four fistulous openings in the skin surface about the anal orifice, which did not seem to communicate with the rectum. He removed some tissue for histologic examination and advised against any surgical procedure until the child is several years old.

The pathologist reported characteristic tuberculous granulation tissue. Three cutaneous tuberculin tests have been negative. Roentgen-ray examination of the chest shows some infiltration extending out from the right hilum into the right upper lobe, which suggests the possibility of tuberculosis. Two Wassermann tests have been made on his blood and both were negative. He has had no fever since he has been in the hospital, his weight has increased satisfactorily,

and the rickets has healed, as evidenced by roentgen-ray examination. We are practically forced to conclude that these anal fistulas are of tuberculous origin.

LIPODYSTROPHY. Presented by DR. PARMELEE.

This girl, aged 10 years, was brought to my office on Oct. 16, 1925, with the complaint that her face was thin and pale. She felt well, had a good appetite, slept well at night, played vigorously and normally with other children, did not tire easily and in every way acted like a normal child. She had gained about 7 pounds in the last eight months. The thinness of her face was first noticed about four years ago, shortly after her tonsils had been removed. Gradually the thinness became more pronounced and the pallor more noticeable. She was the second child and was born at full term, weighing 8 pounds, 4 ounces. The first child is living and well; there have been no miscarriages. This child was breast-fed for the first eight months and developed normally in every way. She had whooping cough at 3 years, influenza at 2½ years, chickenpox and measles at 4 years and mumps at 8 years of age. She also had an attack of cervical adenitis at 8 years, which lasted for several weeks. The family history is entirely negative.

When seen before removing her clothes, she gave the impression of being a sick child, but when the clothes were removed I saw a well nourished and perfectly normal appearing body from the clavicles down. The abdomen, hips and legs were especially well covered with fat. The panniculus adiposus seemed normally thick on the chest, arms and abdomen, but was conspicuously lacking on the neck, face and scalp. The face looked as does that of an athreptic infant whose sucking pad is gone. Further physical examination disclosed nothing abnormal. The laboratory findings were as follows:

Roentgenograms showed a normal skull and sella.

Blood: Calcium, 10.8 mg. per hundred cubic centimeters; urea, 22 mg. per hundred cubic centimeters; uric acid, 2.4 mg. per hundred cubic centimeters; creatinin, 1.15 mg. per hundred cubic centimeters; total nonprotein nitrogen, 24 mg. per hundred cubic centimeters; blood sugar, 102 mg. per hundred cubic centimeters.

Metabolic rate as compared with normal, 7. The blood Wassermann reaction was negative. The urinalysis was normal.

Blood: Hemoglobin, 83; red blood cells, 4,580,000; white blood cells, 12,000. The differential count was within normal limits. The tuberculin cutaneous reaction was negative.

PATHOLOGIC SPECIMENS. Presented by DR. C. C. GUY.

I have two specimens of interest, both from children, aged 5 years. The first patient was a colored boy, who came into the hospital in April, 1925. Two months before entrance he fell and bumped his knee, immediately complained of severe pain and was unable to walk home. Following, this the knee was swollen and painful and he walked with a limp. His mother stated that he had always been well before this injury. On examination, there was a globular swelling of the right femur, a slight elevation of temperature and leukocytosis but no other pathologic findings. He was in the hospital for nearly two months, during which time the swelling became more marked and more tender. On admission, the range of motion in the kneejoint was practically normal but this gradually decreased. The child became more and more

emaciated and the temperature continued slightly elevated. The first diagnosis was osteomyelitis of the lower end of the femur, but later the roentgen-ray findings suggested a tumor process. The boy developed a cough, with a little bloody sputum, and findings of fluid in the chest. He died in June, and at necropsy we found a tumor mass in the lower end of the femur. It was not attached to the skin, but had infiltrated the soft tissues about the lower end of the bone and the vessels and nerves in the popliteal space. There were no other masses in the leg, but examination of the chest showed that the lungs were studded with metastases which occupied three-fourths of the tissue, the rest being atelectactic. We also found metastases in the ribs, mediastinum and the retroperitoneal tissues. Microscopic examination proved the tumor to be a fibrosarcoma, probably of periosteal origin, and the sections from the lungs showed its pronounced osteoblastic character. We have had quite a large series of malignant bone tumors, but this is the only one that has come to necropsy in the last year in a patient so young. Because of this, and because of the rapid development of the condition, resulting in death four months after its initial appearance, the case is of interest.

This other specimen is one that was removed surgically from a colored girl, aged 5 years, who was admitted to the hospital in June, 1925. The mother stated that the child had always been well but when she was three years old she noticed an orange-sized tumor in the upper right quadrant of the abdomen. She paid little attention to it because the child made no complaint. The tumor gradually increased in size, filling the right upper quadrant of the abdomen and bulging out the rib margins. About a year later partial urinary incontinence appeared and has persisted. The child was not brought into the hospital until the tumor had been present for two years. At that time it extended down to Poupart's ligament on the right side, and to the outer portion of the left rectus muscle. It was not nodular or tender and was fixed in position. The other findings, including the white count and routine laboratory work, were normal. The diagnosis was tumor of the kidney, probably embryonic and of the mixed type. Cystoscopic examination showed some dilatation of the right kidney pelvis, with clubbing of the calices. Dr. Eisendrath exposed the tumor mass retroperitoneally and removed it. There was a remnant of kidney tissue with two distinct pelves and two ureters, which joined about 4 inches from the tumor. There was no line of demarcation between the tumor and the kidney itself. The tumor tissue is distinctly lobulated, glistening yellow-white and gelatinous on section. Microscopic examination proved it to be an embryonal adenosarcoma of the kidney. No muscle tissue was found. The child made an uneventful postoperative recovery, and it will be interesting to see if any recurrence or metastases develop.

CHRONIC HEPATITIS. Presented by DR. GEORGE MUNNS.

This child was born at the Iowa State University Hospital, and the labor was normal. Ten days after birth he was circumcised. Hemorrhage from the wound followed and continued for three days, when there was also hemorrhage from the umbilicus and blood transfusion was necessary. On the eighteenth day, jaundice was first noticed and on the twentieth day the stools were clay colored. The general condition seemed good, the child gained weight and did fairly well. He was transferred to the Pediatric Department of the Iowa State University Hospital, where it was found that the Wassermann and Pirquet tests were negative. The jaundice varied in intensity and there were frequent, unexplained rises in temperature. On March 18, 1925, he was

admitted to the pediatric service of the Presbyterian Hospital in this city. The mother complained that the child was extremely jaundiced and had always been so, that he had a tendency to constipation and failed to gain in weight properly. He was then 11 months old. There was icterus and enlargement of the liver and spleen; the Wassermann reaction, Pirquet test and urinalysis were negative, the van den Bergh test of the blood serum gave an indirect reaction. Roentgen-ray examination showed only rachitic changes in the long bones. During his stay in the hospital he ran an unexplained temperature and his appetite was variable. The jaundice varied in intensity from day to day. The stools were sometimes yellow but more often acholic. After eighteen days in the hospital, the child was discharged with a diagnosis of congenital atresia of the bile ducts.

The child was readmitted fifty-eight days later, the mother complaining that there had been no gain in weight for two weeks and that the jaundice persisted. Previous to that he had been in good condition. The abdomen was greatly distended, the liver and spleen much enlarged. The urine showed a trace of albumin and gave a positive bile test. The temperature varied between 99 and 100 F. Permission for operation was refused and the child was taken home, but was readmitted a few days later. The abdomen had then become more distended and the child was drowsy. There was also marked edema of the extremities and face, a loud systolic heart murmur and evidence of fluid in the abdomen. Paracentesis was performed and 450 c.c. of fluid was removed from the abdomen, cultured and reported negative for any organism. The liver could then be palpated and was quite large and firm. Blood examination showed increased anemia but a relatively normal differential count. The following day, 250 c.c. of fluid was removed from the abdomen, and on the eighteenth day 610 c.c. was removed. The following day the child developed bronchopneumoina and died within twenty-four hours.

Necropsy showed that the common, hepatic and cystic ducts were normally patent. Grossly and microscopically, there was a chronic, generalized, fibrous hepatitis. The normal lobular arrangement was entirely replaced by isolated groups of large and small epithelial cells and fibrous tissue.

CEREBROSPINAL FLUID IN THE NEW-BORN. Presented by DR. A. LEVINSON, DR. GREENGARD and DR. H. LIFVENDAHL.

We studied 100 new-born infants. With few exceptions, the cerebrospinal fluid was withdrawn from one to twenty-four hours after birth. We first used lumbar puncture, but later resorted to cistern puncture as we found we could get more fluid by the latter method. The amount obtained by lumbar puncture varied from 5 drops to 5 c.c., the average being 3 c.c. In cistern puncture the amount varied from 1.5 c.c. to 10 c.c., with an average of 6 c.c. Of the fluids twelve were colorless, four were blood stained, twenty-four were blood tinged, and in the rest the color ranged from pale to deep yellow. We used the nitric acid test to determine whether the yellow color was due to bile, but not finding this test sufficiently sensitive we used the van den Bergh test on a series of cases and found both the direct and indirect test negative. We therefore concluded that the yellow color of the cerebrospinal fluid of the new-born was not due to bile. The pressure of the fluid varied. In that obtained by lumbar puncture the pressure ranged from 1 to 6 mm. of mercury, with an average of 4.5 mm. In fluid obtained by cistern puncture, the pressure ranged from 6 to 40 mm., with an average of 25 mm. of mercury. Allowance must frequently be made for external factors, such as crying, position and length of

the needle, all of which influence the pressure. It usually takes from one to thirty-five seconds for the first drop of fluid to appear after spinal puncture. The ordinary needle may be used even when pressure readings are to be taken, the pressure apparatus being attached directly to the needle. In order to measure the pressure of fluid obtained by cistern puncture, one should use a needle with a stop cock. The rate of flow varies according to the site of puncture. In lumbar puncture the flow is very slow, whereas in cistern puncture it is quite rapid. Lumbar puncture is more successful if one uses a needle from 1¼ to 1½ inches in length and 22 gage, and if the needle is introduced at a high level of the spine. There is no formula for success in spinal puncture in a new-born infant any more than in older children, but the higher in the canal the puncture is made, the better. One interspace above the crest of the ileum seems to be the proper place. The puncture should always be made with the child lying down. For cistern puncture, the landmark is just below the lowest occipital prominence. None of our patients showed any complication either as the result of lumbar puncture or of cistern puncture. In one case there was a little hemorrhage from the cistern wound that lasted for a couple of hours, but the deep jaundice of the child could account for the hemorrhage.

TETANUS. Presented by DR. W. L. KENNEY.

In the last four and a half years, 104 cases of tetanus have entered the Cook County Hospital. Of these, forty-one were assigned to the children's ward, and several children, aged 12, were admitted to the adult wards, making the number of children approximately 50 per cent. of the total cases. Most of the conditions occurred during the summer months, July predominating. The incubation period averages from one to twenty-one days, in 50 per cent. being from three to nine days, with eight patients showing no port of entry and no estimation of the incubation period. Our records agree with those of others that the shorter the incubation period the more grave the prognosis and the higher the mortality. In our forty-one cases the mortality rate was 36.6 per cent. Of the entire 104 cases, there was no record of any prophylactic antitetanic serum at the time of the injury. At the Cook County Hospital all patients showing abrasions, gunshot wounds and the like, receive a prophylactic dose of antitetanic serum (1,500 units), and to the best of our knowledge not a single patient has developed tetanus. In our patients, the duration of symptoms varied and the amount of tetanic serum varied, and in order to draw conclusions as to the relative importance of antitetanic serum the cases had to be selected. We took cases of equal incubation period and with about the same duration of symptoms before the antitetanic serum was administered, and compared the dosage as to the amount given at time of entrance and the total amount given during the patient's stay in hospital.

From this investigation, we conclude that massive doses of antitetanic serum, at least 40,000 units, should be given as soon as the diagnosis is made. As with diphtheria antitoxin, the total amount of antitetanic serum to be given should be calculated and administered at once. We believe that this will soon become the routine treatment of tetanus.

(*To be Continued*)

Book Review

DISEASES OF INFANTS AND CHILDREN. By H. D. CHAPIN, M.D., and L. T. ROYSTER, M.D. Fifth revised edition. Illustrated. New York: William Wood & Company.

The new edition of this excellent book has been rewritten to bring it up to date. It is dedicated in memory of Dr. Godfrey R. Pisek, whose untimely death cut short a brilliant career. The co-author with Dr. Chapin is now Dr. Royster.

Much of the edition has necessarily been rewritten and some of the chapters are considerably enlarged. Those on "Scarlet Fever" and other communicable diseases have received special consideration, and contain excellent colored illustrations of these conditions. New illustrations have been added in other parts of the book, and an entirely new chapter has been written on "The Care of the Dependent Infants and Children," giving a valuable discussion of the subject. The book should have the same success as has had all previous editions.

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